Draft Environmental Assessment addressing the Application for an Incidental Take Permit for the Lalamilo Wind Farm Habitat Conservation Plan

PREPARED FOR

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September 2017

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SUMMARY

Title for Proposed Action: Preliminary Draft Environmental Assessment addressing an application for an Incidental Take Permit (ITP) for the Lalamilo Wind Farm Habitat Conservation Plan

Legal Mandate for Proposed Action: Section 10(a)(1)(B) of the Endangered Species Act (ESA), as amended, as implemented by 50 Code of Federal Regulations (CFR) 17.22 for endangered species and 50 CFR 13 regarding issuance and administration of permits

Applicant: Lalamilo Wind Company, LLC

Permit Number: Not yet applicable

Conservation/Funding Plan: The U.S. Fish and Wildlife Service is proposing to issue an ITP and approve the Habitat Conservation Plan for the Lalamilo Wind Farm to be operated by the Lalamilo Wind Company, LLC (the Applicant) in South Kohala on the Island of Hawaii. Over its 20-year life, the ITP would authorize take of up to six Hawaiian hoary bats and three Hawaiian petrels, which are incidental to Project operation and decommissioning. Consistent with the requirements of the ESA, the Applicant would minimize the potential for take with off-site habitat conservation measures designed to mitigate the impacts of the takings on the bat and the petrel, and monitor and report on implementation and effectiveness of the Habitat Conservation Plan. These measures and other requirements are detailed in the Applicant's Habitat Conservation Plan, which is part of its application for an ITP.

Duration: 20 years

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ACRONYMS AND ABBREVIATIONS

ALISH	Agricultural Lands of Importance to the State of Hawaii
amsl	above mean sea level
APLIC	Avian Power Line Interaction Committee
Applicant	Lalamilo Wind Company, LLC
BLNR	Board of Land and Natural Resources
CARE	carcass retention
CFR	Code of Federal Regulations
CP	carcass persistence
DHHL	Department of Hawaiian Home Land
DLNR	Department of Land and Natural Resources
DOE	Department of Energy
DOFAW	Division of Forestry and Wildlife
DWS	Department of Water Supply
ESA	Endangered Species Act
ESRC	Endangered Species Recovery Committee
GPS	global positioning system
ha	hectare
HCP	Habitat Conservation Plan
HELCO	Hawaii Electric Light
HRS	Hawaii Revised Statute
HVNP	Hawaii Volcanoes National Park
ITL	Incidental Take License
ITP	Incidental Take Permit
km	kilometer
kW	kilowatts
kV	kilovolt
LWF	Lalamilo Wind Farm
m	meter
m/s	meters per second
MBTA	Migratory Bird Treaty Act
MW	megawatt
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
PPA	Power Purchase Agreement
Project	Lalamilo Wind Farm Repowering Project
RFP	Request for proposals
SEEF	searcher efficiency
SWCA	SWCA Environmental Consultants
Service	U.S. Fish and Wildlife Service
USC	U.S. Code
USAG	U.S. Army Garrison

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. CHAPTER 1: INTRODUCTION

This environmental assessment (EA) examines the potential environmental effects of the proposed issuance of an Incidental Take Permit (ITP) and approval of a Habitat Conservation Plan (HCP) (SWCA Environmental Consultants [SWCA] 2016) for two federally listed threatened or endangered species—Hawaiian hoary bat, or ʻope'apeʻa, (*Lasiurus cinereus semotus*) and Hawaiian petrel, or ʻuaʻu, (*Pterodroma sandwichensis*)—under Section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973, as amended (87 Stat 884, 16 U.S. Code [USC] 1531 et seq).

1.1. Background

Lalamilo Wind Farm (LWF), located near the town of Kamuela, South Kohala District, Island of Hawaii, was originally constructed in the mid-1980s with 120 wind turbines for an installed generating capacity of 2.7 megawatts (MW). It was decommissioned in 2010 in anticipation of re-powering the site.

In 2013, the County of Hawaii Department of Water Supply (DWS) awarded Lalamilo Wind Company, LLC (the Applicant) a contract to design, build, and operate the wind farm and associated facilities for the Lalamilo Wind Farm Repowering Project (the Project). The DWS operates eight existing water wells at the wind farm site for a combined available water capacity of 5 million gallons per day in the Lalamilo-Parker well system. The Project is anticipated to generate 75% to 80% of the pumping energy demands in this well system, thereby reducing annual pumping costs over the next 20 years. The effects of construction and operation of the Project were analyzed and disclosed in a previous EA (Tetra Tech 2014).

Based on past wildlife studies at the wind farm site, the Applicant has determined that incidental take could occur as a result of Project operations for two federally listed species. These species are hereafter referred to as *Covered Species*:

- Hawaiian hoary bat (federally listed and state-listed endangered)
- Hawaiian petrel (federally listed and state-listed endangered)

Construction commenced in September 2015, and the facility is estimated to start commercial operation once a decision is made on issuance of an ITP and ITL. The Service received a letter from Lalamilo Wind Company, LLC, dated December 7, 2016 in response to the Service's inquiry about operational status of the Project. The letter affirmed that the construction has been completed and the current operations consist of test running two turbines at a time. The turbines are and would continue to be curtailed between 1 hour prior to sunset and 1 hour after sunrise during this testing. This would present minimal risk to the two endangered listed species, Hawaiian hoary bat and Hawaiian petrel, included in the HCP as Covered Species, because those two Covered species are nocturnal. Ground searches are being conducted for any downed wildlife, and no downed wildlife has been documented.

To comply with the ESA and to avoid potential violations of the ESA Section 9 prohibition, the Applicant has prepared an HCP and intends to apply for an ITP in accordance with Sections 10(a)(1)(B) and 10(a)(2) of the ESA. The Applicant will also apply for an Incidental Take License (ITL) with the State of Hawaii's Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), pursuant to Hawaii Revised Statute (HRS) Chapter 195-D.

The ITP evaluated in this EA would allow for total adjusted take (observed, unobserved, and indirect) of six Hawaiian hoary bats and three Hawaiian petrel under the proposed action or 10 Hawaiian hoary bats and three Hawaiian petrel under Alternative 3 (discussed below in Chapter 2).

1.2. Project Location and Description

The Project is located on the lower (western) flank of the Mauna Kea volcano, between Waimea and Waikoloa Village, Hawaii (Figure 1) on state land zoned as "agriculture" and leased from the DLNR. The Applicant owns and operates the Project.

Key Project components include five 660-kW Vestas V47 wind turbines, for an installed generation capacity of 3.3 MW, as well as an updated monitoring and control system to optimize the operations of the pumping system. Associated infrastructure also includes access roads; an electrical collection system; one guyed meteorological tower measuring 60 m (197 feet) and two 30-m (88-foot), free-standing, lattice radio towers; a 12 × 11–m (40 × 37–foot) operations and maintenance building; a 13-kilovolt (kV) overhead electrical transmission line measuring 2.1 km (1.3 miles) long; and switchgear and electrical interconnection equipment (Figure 2). Each of these components is discussed in Section 3.2 of the HCP (SWCA 2017).

No new construction or modification of Project components would occur under the ITP.

The Project has an estimated 40-year life based on the projected useful life of the turbines. At an appropriate time before the completion of the 20-year term of the Power Purchase Agreement (PPA) between the DWS and the Applicant, the DWS would evaluate whether to continue operation of the Project or decommission it. If the Project is decommissioned, the power generation equipment would be removed before the expiration of the ITP and the site would be returned to a condition as close to its pre-construction (post-2010-decommissioned) state as possible, as contractually required in both the lease with the DLNR and the PPA with the DWS.

1.2.1. Covered Activities and Permit Term

The *Covered Activities* for this EA are activities related to the operation, maintenance, and decommissioning of the proposed Project that may cause take of Covered Species.

The ITP would provide take authorization for 20 years from the effective date of the authorization. This covers the contract term of the PPA between the Applicant and DWS. Should continued operation of the Project be deemed appropriate beyond this permit term, the Applicant or then owner/operator of the project would apply for an ITP amendment.

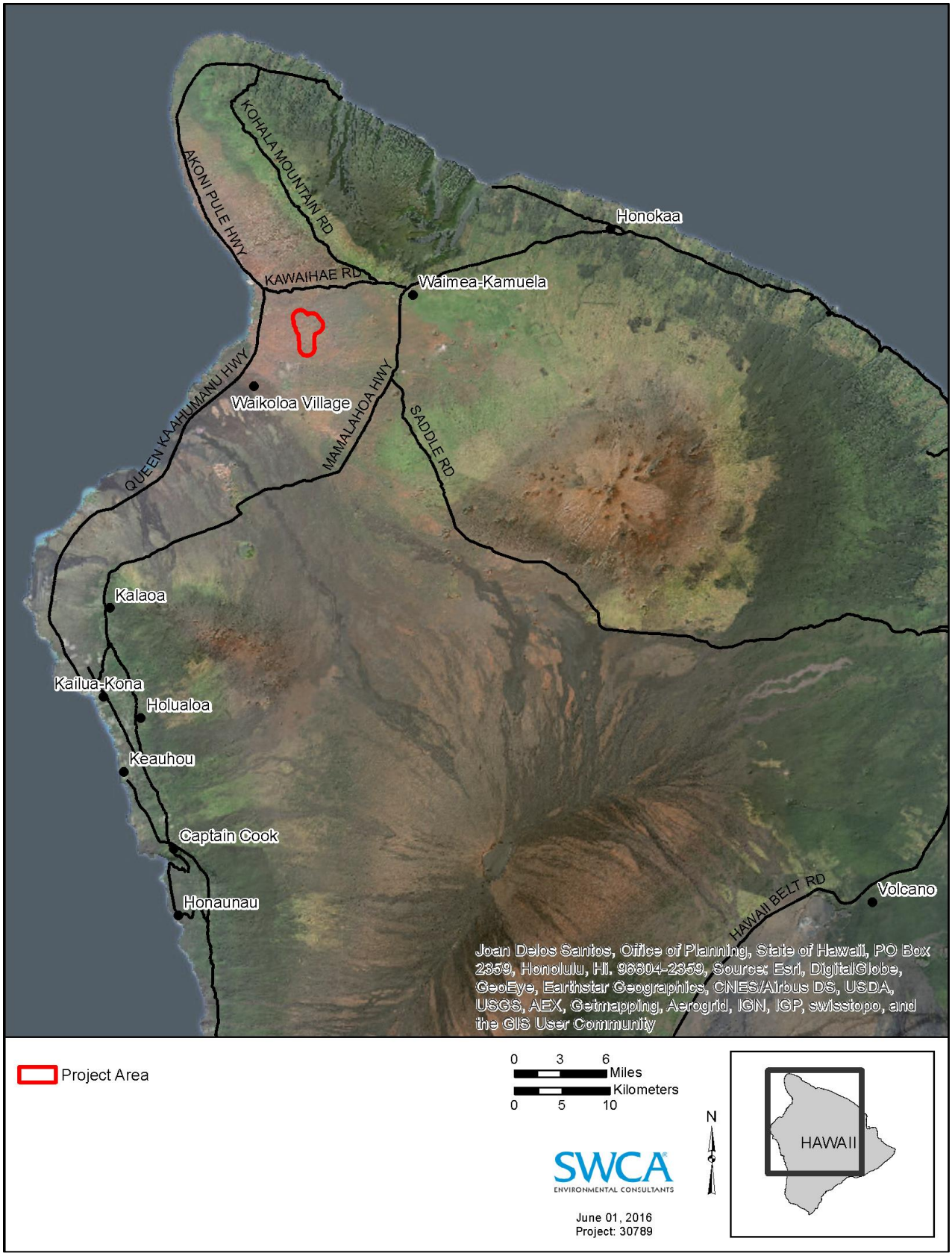


Figure 1. Location of the Project.

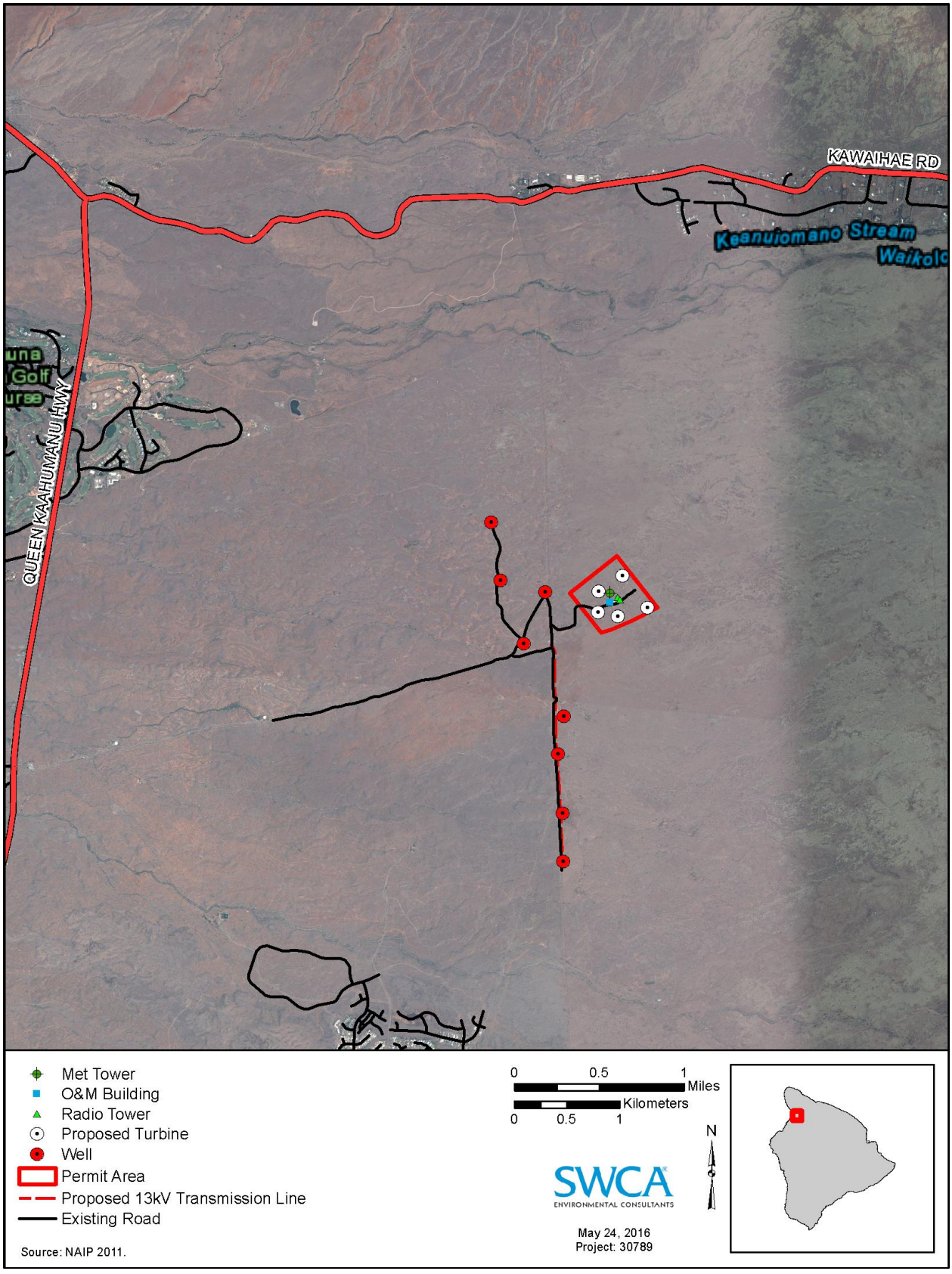


Figure 2. Proposed design of the Project.

1.3. Purpose and Need for Action

The proposed Federal action considered in this EA is the issuance of an ITP in response to a permit application submitted with an HCP in accordance with the requirements of section 10(a)(1)(B) of the ESA. If approved, the ITP would authorize incidental take of the Covered Species, Hawaiian hoary bat and Hawaiian petrel, caused by Covered Activities.

The Service's purpose is to fulfill ESA section 10 conservation obligations. Non-Federal applicants whose otherwise lawful activities may result in take of ESA-listed wildlife can apply to the Service for a section 10(a)(1)(B) ITP so that their activities may proceed without potential violation of the ESA section 9 prohibition against such take.

In considering the permit application, the Service must comply with a number of Federal laws and regulations, Executive Orders, and agency directives and policy. As the Service fulfills these responsibilities and obligations they will strive to:

- ensure that issuance of an ITP and implementation of the HCP achieve long-term conservation objectives for species and ecosystems at ecologically appropriate scales; and
- ensure that conservation actions under the HCP occur within a spatially explicit landscape conservation design capable of supporting species mitigation projects over the long term or for a period commensurate with the scope of the take impacts caused by Covered Activities on Covered Species.

The Service's need for the action is to respond to the application for an ITP. When an application for an ITP is received, the Service reviews the application to determine if it meets issuance criteria.

The Services will also need to ensure that issuance of the ITP and implementation of the HCP comply with other applicable Federal laws, regulations, and treaties such as NEPA, NHPA, MBTA, BGEPA, and Executive Orders 11998, 11990, 13186, 12630, and 12962, as appropriate.

On January 23, 2017, the Service received an ITP application from Lalamilo Wind Company, LLC. If the application is approved and the Service issues an ITP, the permit would authorize the take of Covered Species caused by Covered Activities as stipulated on the ITP. The ITP may also contain other measures to mitigate adverse effects to other resources under the Service's jurisdiction (e.g., ESA-listed plants, marine mammals, migratory birds, or eagles) caused by Covered Activities under the HCP.

The Service has prepared this EA to:

- Inform the public of the proposed and alternative actions and their effects on the human environment;
- Seek information from the public; and
- Use the information collected and analyzed to make better informed decisions concerning this ITP application.

1.4. Decision to Be Made

As a condition of receiving an ITP, an applicant must prepare and submit to the Service for approval an HCP containing the following mandatory elements set forth under section 10(a)(2)(A) of the ESA:

- The impact that would likely result from the taking
- What steps the applicant would take to minimize and mitigate such impacts, the that would be available to implement such steps;
- What alternative actions to such taking the Applicant considered, and the reasons why such alternatives are not utilized; and
- Such other measures that the Service (under authority delegated by the Secretary of the Interior) may require as being necessary or appropriate for the purposes of the HCP.

Under provisions of the ESA, the Service (under authority delegated by the U.S. Secretary of the Interior) would issue an ITP if the application meets the following issuance criteria identified in section 10(a)(2)(B) of the ESA and implementing regulations:

- That the taking of the listed species would be incidental;
- That the Applicant would, to the maximum extent practicable, minimize and mitigate the impacts of such taking on the species;
- That the Applicant would ensure that adequate funding for the implementation of the HCP, including procedures to deal with unforeseen circumstances would be provided;
- The taking would not appreciably reduce the likelihood of survival and recovery of the species in the wild; and
- Other measures required by the Service as being necessary or appropriate for purposes of the HCP would be implemented

The Service will document its assessment of the ITP and HCP in an ESA section 10 findings document. If the Service makes the requisite findings, the Service will issue the ITP and approve the HCP. In such cases, the Service will decide whether to issue the ITP conditioned on implementation of the proposed HCP as submitted, or as amended to include the other measures the Service determines are necessary or appropriate. If the Service finds that the requisite criteria are not satisfied, the permit request will be denied.

1.5. Relationship to Laws, Regulations, Plans, and Policies

Key relevant laws, regulations, and policies that affect the development and implementation of an HCP, ITP, ITL, and EA for the Project are summarized below.

1.5.1. Federal Regulatory Context

1.5.1.1. NATIONAL ENVIRONMENTAL POLICY ACT

The proposed issuance of an ITP by the Service is a Federal action that may affect the human environment and that therefore is subject to review under NEPA (42 USC 4321 et seq). NEPA requires that Federal agency decision-makers, in carrying out their duties, use all practicable means to create and maintain conditions under which people and nature can exist in productive harmony and fulfill the social, economic, and other needs of present and future generations of Americans. NEPA provides a mandate

and a framework for Federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to involve and inform the public in the decision-making process. The act also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and recommend national policies that ensure that the programs of the Federal government promote improvement of the quality of the environment. The CEQ set forth regulations (40 CFR 1500–1508) to assist Federal agencies in implementing NEPA during the planning phases of any Federal action. These regulations, together with specific Federal agency NEPA implementation procedures, help ensure that the environmental impacts of any proposed decisions are fully considered and that appropriate steps are taken to mitigate potential environmental impacts.

1.5.1.2. ENDANGERED SPECIES ACT

The ESA provides broad protection for plants, fish, and wildlife that have been listed as threatened or endangered in the U.S. or elsewhere and conserves ecosystems on which these species depend (16 USC 1531–1544). Section 9 of the ESA prohibits the unauthorized take of any endangered species of fish or wildlife listed under the ESA. *Take* means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct (50 CFR 17.3). *Harm* has been defined by the Service to mean an act that actually kills or injures wildlife, and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* has been defined to mean an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns that include but are not limited to breeding, feeding, or sheltering (50 CFR 17.3). Section 10 of the ESA contains exceptions and exemptions to Section 9, if such taking is incidental to the carrying out of an otherwise lawful activity.

1.5.1.3. MIGRATORY BIRD TREATY ACT

Nearly all native migratory birds of the U.S. are protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC 703–712 et seq). The one bird species, the Hawaiian petrel, covered in the HCP and other non-federally listed bird species that may occur in the Project area, including the Pacific golden-plover (*Pluvialis fulva*), sky lark (*Alauda arvensis*), and pueo (*Asio flammeus sandwichensis*), are protected under the MBTA. This act states that it is unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; and possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product. *Take* is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." No process for authorizing incidental take of MBTA-protected birds or for providing permits is described in the MBTA (U.S. Fish and Wildlife Service and NMFS 1996). In this case, if the HCP is approved and the Service issues an ITP to the Applicant, the terms and conditions of that ITP will also constitute a Special Purpose Permit under 50 CFR 21.27, and any take of Covered Species will not be in violation of the MBTA. Take of other non-federally listed MBTA bird species may not be authorized under the ITP and Special Purpose Permit, however.

On March 23, 2012, the Service released their *Land-Based Wind Energy Guidelines* (U.S. Fish and Wildlife Service 2012). These voluntary guidelines provide recommended approaches for assessing and avoiding impacts to wildlife and their habitats, including migratory birds, associated with wind energy project development. The guidelines also help ensure compliance with Federal laws such as the MBTA. The Applicant has incorporated this guidance in their siting and operation plans to avoid and minimize impacts to MBTA-protected species (see Section 2.2.1).

1.5.2. State Regulatory Context

1.5.2.1. STATE ENDANGERED SPECIES ACT

The purpose of HRS Chapter 195D (Conservation of Aquatic Life, Wildlife, and Land Plants) is "to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems…" (HRS 195D-1). Section 195D-4 states that any species of fish or wildlife recognized by the ESA as endangered or threatened shall be so deemed by state statute, and like the ESA, it prohibits the unauthorized take of such endangered or threatened species (195D-4(e)). Under Section 195D-4(g), the Board of Land and Natural Resources, after consultation with the state's Endangered Species Recovery Committee, may issue an ITL to allow a take otherwise prohibited if the take is incidental to the carrying out of an otherwise lawful activity.

1.5.2.2. HAWAII REVISED STATUTES, CHAPTER 343

Because the Project occurs on state lands, the Proposed Action is subject to compliance with the State of Hawaii Environmental Impact Statement law, HRS Chapter 343. As part of the Chapter 343 process, an EA is required to fulfill state requirements and to evaluate the potential environmental impacts of, and potential alternatives to, issuing an ITL and approving the implementation of the proposed HCP. This Federal EA will fulfill state EA reporting requirements.

1.6. Scope of Environmental Assessment

The Service has prepared this EA to evaluate the impacts of issuing an ITP to authorize incidental take of two Covered Species and commensurate mitigation would have on the Covered Species. The analysis and conclusions on climate; geology and topography; soils; and hydrology and fresh water botanical, archaeological and historical, cultural, transportation and traffic, and visual resources described in the Final Environmental Assessment and Finding of No Significant Impact for Lalamilo Wind Farm Repowering Project (Tetra Tech 2014) are incorporated by reference into this EA and are not reanalyzed in this document. The previous analyses on the impacts of construction and operation of the Lalamilo Wind Repowering Project on these resources have not changed in scope or intensity since the finalization of the 2014 EA (Tetra Tech 2014) and completion of project construction in 2016.

The Project is not located within designated critical habitat. Wildlife resources that may utilize or transgress across the Project area include ESA listed species and non-listed species. The non-listed wildlife includes Hawaii State Species of Greatest Conservation Need, Migratory Bird Treaty Act (MBTA)-protected species, and species that do not have a special status. Impacts to the Hawaiian goose, Newell's shearwater, Blackburn's sphinx moth, and Hawaiian hawk were evaluated in the 2014 EA (Tetra Tech 2014) because the species may transgress across the site and the analysis is incorporated by reference in Table 1. With the exception of the Covered Species, the Hawaiian hoary bat and Hawaiian petrel, no other federally listed threatened or endangered species have been documented using the Project area (Tetra Tech 2014; Table 1). The newly listed band-rumped storm petrel (*Oceanodroma castro*) could potentially transit over the Project site. Non-listed species could also utilize or transit across the Project area. The scope of this EA will include the Hawaiian hoary bat, Hawaiian petrel, Band-rumped storm petrel, and non-listed species that may utilize or transit across the Project and may be impacted by the proposed action.

Table 1. Species with Potential to Occur in the Lalamilo Project Area.

Common, Hawaiian Name(s)	Scientific Name	Status	Additional analysis conducted or, if not carried forward, the annotated results from the 2014 EA (Tetra Tech) incorporated by reference, or other supporting science
Hawaiian hoary bat, ‘ope’ape’a	*Lasiurus cinereus semotus*	Endangered	Yes, could utilize the site for foraging or transit across site
Hawaiian petrel, ‘ua’u	*Pterodroma sandwichensis*	Endangered, MBTA	Yes, based on colony presence and surveys, the species could transit across the site
Non-listed species	*Various*	MBTA, introduced, indigenous, state species of concern	Yes, could utilize or transit across the Project site
Hawaiian goose, nene	*Branta sandvicensis*	Endangered, MBTA	No. Hawaiian goose are known to breed within approximately 10 miles (16 km) of the wind farm. There is a lack of quality food available within the Project area and it is not considered high quality habitat. There is an abundance of similar habitat through the region and there is a low probability of the species using the specific Project area (Tetra Tech 2014). Individual birds could transit the project during daylight hours between foraging grounds, but the risk of take is negligible given the size of the project and the high probability that these birds will detect and avoid turbines and other Project components. Therefore, impacts to this species are highly unlikely.
Newell’s shearwater, ‘a’o	*Puffinus newelli*	Threatened, MBTA	No. On the Island of Hawaii, nesting colonies have only been confirmed in the Puna District on the eastern side of the island and distant from the Project (Ainley et al. 1997, Reynolds and Ritchotte 1997). While the Project area is not situated along a flight path likely to be used by Newell’s shearwaters, individual birds could fly over the Project area in transit between the ocean and nesting grounds, but the risk of take is extremely low (Tetra Tech 2014).
Band-rumped storm petrel, ‘ake’ake	*Oceanodroma castro*	Endangered, MBTA	No. There is a lack of evidence to support the presence of colonies that will transit across the site. Consistent seasonal activity and documented flight patterns on the southeast flank of Mauna Loa suggests *O. castro* approach high-elevation colonies (i.e., above 2600 m) from the east and southeast coasts (Swift and Burt-Toland 2009). The nearest colony is located at Pohakoloa Training Area (USAG-Pohakuloa 2016).
Blackburn’s sphinx moth	*Manduca blackburnii*	Endangered	No. Blackburn’s sphinx moths or their larvae were not observed during reconnaissance surveys; no larval host plants are present and only one nectar plant was observed during same survey (Tetra Tech 2014). No larval host plants were observed during the Endangered Species Recovery Committee site tour in 2016.

Table 1. Species with Potential to Occur in the Lalamilo Project Area.

Common, Hawaiian Name(s)	Scientific Name	Status	Additional analysis conducted or, if not carried forward, the annotated results from the 2014 EA (Tetra Tech) incorporated by reference, or other supporting science
Hawaiian hawk	*Buteo solitarius*	Endangered, MBTA	No. The dry grassland vegetative community in the Project area is not suitable nesting or foraging habitat for the Hawaiian hawk. The hawk could transit the Project area when flying between suitable nesting and foraging habitat in the Kohala Mountains to the north and on the forested slopes of Hualālai to the south during daylight hours, but the risk of take is extremely low (Tetra Tech 2014).
Orangeblack damselfly	*Megalagrion xanthomelas*	Endangered	No; damselfly is highly unlikely to transgress through the project site because slow or standing water sources are absent from the wind farm. Suitable resources are not present and Project actions would not rise to the level of incidental take. Therefore, this species was not carried forward for analysis.
Yellow-faced bees	*Hylaeus anthracinus*	Endangered	No; presence of larval host plants is absent. Species prefers coast and dry lowlands. Suitable resources are not present and Project actions would not rise to the level of incidental take. Therefore, this species was not carried forward for analysis.

2. CHAPTER 2: ALTERNATIVES INCLUDING THE PROPOSED ACTION

This EA examines the potential impacts of the Proposed Federal Action to determine if they may be significant (42 USC 4332(C)). NEPA regulations require, among other things, that Federal agencies examine all reasonable alternatives to a Proposed Federal Action, including a "No Action" alternative (40 CFR 1500.02). Reasonable alternatives must be practical and feasible from a technical and economic standpoint and must comply with governing standards and regulations. Furthermore, reasonable alternatives, with the exception of No Action, must fulfill the purpose and need for an action to warrant detailed environmental impact analysis.

For this EA, the Service identified four alternatives for consideration:

- Alternative 1 (No Action): All facility turbines would be nonoperational from approximately 1 hour before civil sunset until 1 hour after civil sunrise—i.e., completely curtailed at night. An ITP pursuant to Section 10(a)(2)(B) of the ESA would not be required.
- Alternative 2 (Proposed Action Alternative): Issuance by the Service of the requested Section 10(a)(1)(B) ITP, contingent on the implementation of the Project HCP.
- Alternative 3 (No Curtailment Alternative): No curtailment would mean the turbines would continue to spin in lower wind speeds between dusk to dawn periods and all five turbines would potentially be operating simultaneously with issuance by the Service of an ITP pursuant to Section 10(a)(2)(B) of the ESA.
- Alternative 4 (Increased Cut-in Speed Alternative): This alternative would consist of implementing year-round low wind speed curtailment and blade feathering and increasing the cut-in speed from 5.5 m/s, the current cut-in speed proposed by the Applicant, to 6.5 m/s.

These four alternatives are discussed in the following sub-sections of this chapter and are analyzed in Chapter 3. Section 2.5 reviews alternatives that were considered but eliminated from detailed analysis, and explains why these alternatives were dismissed from consideration.

2.1. Alternative 1 (No Action Alternative)

Under the No Action Alternative, all facility turbines would be nonoperational from approximately 1 hour before civil sunset until 1 hour after civil sunrise—i.e., completely curtailed at night. This alternative would reduce the risk of take of the two Covered species, the Hawaiian hoary bat and the Hawaiian petrel to at or below a negligible level and no ITP would be needed.

Under this alternative the Service would not authorize incidental take of Covered Species the Applicant would not have the regulatory assurance requested to avoid potential violation of the ESA. Any incidental take would not be authorized and the Applicant would assume all legal liability for operating the Project without an ITP.

This alternative would result in complete loss of renewable electricity production from approximately 1 hour before dusk to one hour after dawn. This would likely reduce total renewable-based power production below the minimum level required by the Applicant's purchase power agreement (PPA), resulting in an economically unviable project. The repowering Project requires sufficient energy be supplied for nighttime water well pumping and operational needs. This alternative would preclude the Project from generating the sufficient renewable energy necessary to meet these water pumping needs during the night. Under this alternative, changes to the operational and power supply infrastructure would

be necessary to provide fossil-fuel derived energy to the pumps during nighttime operation. However, inclusion of the No Action Alternative is prescribed by the Federal CEQ regulations (40 CFR 1502.14(d)) and is carried forward for analysis in the EA.

2.1.1. Avoidance and Minimization Measures

Under the No Action Alternative, the Applicant would implement the following measures during Project operation and maintenance to avoid or minimize impacts to Covered Species and other wildlife species that may utilize the Project area:

- Typically, only three of five turbines would be in operation at any given time.
- Minimize nighttime activities to avoid the use of lighting that could attract Hawaiian petrels and possibly Hawaiian hoary bats.
- Minimize use of on-site lighting at buildings and use shielded fixtures. Use on-site lighting on infrequent occasions, for safety reasons, when workers are at the Project at night.
- Observe a maximum speed limit of 40 km (25 miles) per hour while driving on-site, to minimize collision with covered species, in the event they are using habitat on-site or are injured.
- At the on-site operations and maintenance building, use light fixtures that would be shielded and directed downward to avoid attraction and disorientation of night-flying seabirds.
- Place the electrical collection line below ground, thereby reducing the risk of collision for birds and bats.
- The overhead transmission line conductors have been arranged in the same horizontal arrangement as, and parallel to, the existing transmission line, and are designed to avoid the potential for collision by birds by fitting it with bird flight diverters consistent with APLIC guidelines, as determined necessary (APLIC 2012).
- Trees taller than 4.5 m (15 feet) would not be removed or trimmed during the pup-rearing season (June 1–September 15) to avoid impacts to Hawaiian hoary bats.
- To avoid potential for a bat to be caught on a barb, no barbed wire would be used at the project site.
- The establishment of tree tobacco and other known hosts of Blackburn's sphinx moth would be avoided to prevent the establishment on the site of the moth in any of its life stages. All tree tobacco would be removed before reaching a height of 3 feet.
- Best Management Practices would be employed during road building, repair, and operational activities to avoid and minimize the risk of introduction of weedy and invasive species, such as ants and tree tobacco.
- Best Management Practices would be employed to minimize introducing changes in the landscape that would attract fauna, such as altering flora and creating ponded water.
- Best Management Practices would be employed during road building, repair and operational activities to minimize dust emissions.

In addition, complete nighttime curtailment (feathering of blades into the wind) of the five turbines would be implemented daily between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 06:30/07:00 a.m. (approximately 1 hour after civil sunrise) year round.

Under the No Action Alternative, the Service cannot be assured of the continued implementation of the measures described above, although failure to implement these measures could result in ESA violations and potential enforcement action against Lalamilo Wind Company, LLC. Failure to implement the above measures would also likely increase the adverse environmental effects of the No Action Alternative to the human environment. The HCP proposed by the applicant includes additional mitigation and funding for off-site benefits to Covered Species. Under the No Action Alternative, this mitigation and funding would not be available.

2.2. Alternative 2 (Proposed Action)

Alternative 2 is the Proposed Federal Action. This action would be the issuance of a Section 10(a)(1)(B) 20-year ITP (from the date of issuance) to the Applicant to authorize incidental taking of Covered Species that may result from Covered Activities and avoid, minimize, and mitigate for the authorized incidental take. Covered Activities are discussed in Section 1.2.1 of this EA and Section 5 of the HCP (SWCA 201).

A summary of the proposed take is provided in Table 2, and rationale for take levels is provided in Section 8 of the HCP (SWCA 2017).

Table 2. Proposed Take of Covered Species

Covered Species	**ITP Authorization**
	20-Year Limit
Hawaiian hoary bat	Tier 1: Up to 3 bats Tier 2*: Up to 6 bats
Hawaiian petrel	Up to 3 birds

*Tier 2 mitigation would be initiated when 66% (2 bats) of Tier 1 take has been reached.

2.2.1. Proposed Avoidance, Minimization, Mitigation, and Management Measures

2.2.1.1. AVOIDANCE AND MINIMIZATION

Under Alternative 2 (Proposed Action), the Applicant would continue to implement the avoidance and minimization measures described in the No Action Alternative during Project testing, operation, and maintenance to avoid or minimize impact to Covered Species and other wildlife species (see Section 2.1.1). In addition, low-wind speed curtailment (feathering of blades parallel with the wind to minimize blade rotation) would be implemented daily between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 6:30/7:00 a.m. (approximately 1 hour after civil sunrise) year round. The low-wind speed curtailment of the Vestas V47 turbines would consist of a cut-in speed of 5.5 m (16 feet) per second, which is the typical standard for low-wind speed curtailment to reduce impacts to bats in Hawaii. Curtailment would be based on 10-minute average wind speeds from each turbine's anemometer. Under this scenario turbines would only be operational at night when wind speeds are above 5.5 m/s. The proposed take estimates are based on the collision fatality risk of three turbines operating simultaneously without implementation of the avoidance and minimization measures or low-wind speed curtailment.

Therefore, the actual take may be less than what is estimated, because of the deployment of the avoidance, minimization, and curtailment measures. In addition to the curtailment at 5.5 m/s, the Applicant would raise the cut-in speed if the rate of incidental take is projected to exceed the requested take for the Projects operational period. The effectiveness that incremental increases in the cut-in speed above 5.5 m/s has on reducing bat fatalities is highly uncertain. Other than complete nighttime curtailment, the cut-in speed necessary to completely avoid take of Hawaiian hoary bat it is unknown. As cut-in speed is increased, renewable energy output decreases and use of energy derived from a source available from dusk to dawn is increased.

2.2.1.2. MITIGATION

Table 3 summarizes proposed mitigation for each of the Covered Species. Mitigation measures proposed to offset Project impacts are based on anticipated levels of incidental take and would be subject to review and approval by the DOFAW and the Service over the life of the Project. Mitigation measures can be modified or continue without modification, depending on measured levels of take and the success of mitigation measures, as agreed upon by the Applicant, the Service, and DOFAW.

Monitoring of the implementation and success of proposed mitigation measures may also lead to implementation of adaptive management. Should alternate mitigation measures or locations be identified or other options be identified that would present the Applicant with a greater chance of meeting the biological goals and objectives of the proposed HCP, the Applicant can propose such alternate mitigation to the Service and DOFAW for approval. Alternative mitigation would require approval by the Service and DOFAW and must meet or exceed the mitigation requirements of the Project.

All required state and Federal permits would be obtained before the implementation of any mitigation measure.

Table 3. Summary of Mitigation Measures for the Proposed Action

Covered Species	Mitigation
Hawaiian hoary bat	• Habitat restoration of 90 acres in HVNP. This restoration includes removal of invasive plants and seeding and outplanting of native shrubs and trees. The 90 acre restoration project area is currently low-value bat habitat, because there are no trees large enough for roosting and the invasive plant species do not support the arthropods on which the Hawaiian hoary bats routinely forage. It is likely that bats simply travel through the proposed mitigation project area *en* route to higher quality areas. Once high quality habitat is created, the mitigation site will provide long-term, forested habitat comprised mostly of native species for roosting, potential pupping, and forest edge foraging habitat for bats. These enhancements will provide resources that positively affect the productivity of Hawaiian hoary bats. This acreage is expected to would fully offset the take of three bats. If Tier 2 is reached, additional take would be mitigated through funding additional habitat restoration in the Kahuku unit of HVNP. This restoration would fully offset the take of 3 additional bats. The methods used by HVNP to achieve this restoration are reliable. Contingency funding for adaptive management, inflation, and to ensure mitigation success criteria are met, are included in the funding structure.
Hawaiian petrel	• Provide funding for monitoring and removal of predators (cats and mongoose) within the recently constructed exclosure protecting the largest subcolony of endangered Hawaiian petrels on Hawaii Island.

2.2.1.3. HAWAIIAN HOARY BAT

Proposed mitigation efforts to minimize the take of the Hawaiian hoary bat would include habitat restoration to facilitate lowland mesic-wet ohia forest recovery. A brief rationale for the use of habitat restoration to offset the potential incidental take follows.

At the request of the Endangered Species Recovery Committee, a Hawaiian hoary bat workshop was held on April 14-15, 2015 in Honolulu Hawaii to discuss issues ranging from take avoidance, to research priorities, to future mitigation strategies. Participants included Hawaiian hoary bat researchers from DOFAW, U.S. Geological Society, U.S. Forest Service, University of Hawaii, Pacific Cooperative Studies Unit, the Service, as well as government regulators, consultants, stakeholders, and the public. On September 8, 2015, DOFAW introduced to the Endangered Species Recovery Committee a white paper outlining new guidelines for ITL applicants regarding bat avoidance, minimization, and mitigation that were based on the outcomes of the 2015 bat workshop. The Service provided comments on the paper, and the document, *Endangered Species Recovery Committee Hawaiian Hoary Bat Guidance Document*, was finalized in December 2015 (Amlin and Siddiqi 2015).

The paper acknowledges challenges in designing mitigation plans due to the paucity of data pertaining to Hawaiian hoary bat conservation. The paper recommends that applicants include both habitat management and research in mitigation proposals. Service suggestions for compensatory mitigation for bats has focused on habitat protection and restoration, including forest and wetlands (Amlin and Siddiqi 2015). Management actions have included fencing, ungulate removal, invasive plant control, seeding and out-planting of native species such as koa. Surrogate measures of mitigation success have included measuring canopy density, out-planting or seeding density, and size of the area made free of invasive species. All land based mitigation actions are accompanied by acoustical monitoring for bats and the monitoring design is based on best practices. The Service and DOFAW suggested the size of a mitigation area needed per bat based on the best, yet limited, science available for the Hawaiian hoary bat. Acreage-based recommendations were based on the foraging pattern of 28 bats and the size of the foraging areas of the male and female bats (Bonaccorso et al. 2015). The core use area for one male Hawaiian hoary bat was recognized by ESRC to be 40 acres (Amlin and Siddiqi 2015). Females, may overlap in core area use and roosting sites. Hawaiian hoary bats are known to roost in native and non-native trees. However, non-native species cause modifications or detrimental changes to trust resources such as water, canopy structure, soil, and species diversity. Degradation and loss of habitat has been identified as a major threat to bats in Hawaii (U.S. Fish and Wildlife Service 1998). Removal and control of invasive species and out-planting are essential components of habitat restoration for protected and non-listed species and is recognized by the Service and DOFAW as an important mitigation action for bats in order to provide net environmental benefits (Amlin and Siddiqi 2015, USFWS 1998).

In order to suggest a consistent and standardized mitigation value for mitigation plans that include research, the cost of mitigation per Hawaiian hoary bat was based on the cost of on-going land-based mitigation projects and determined by DOFAW biologists to be $50,000 (Amlin and Siddiqi 2015). In recognition of the need for better scientific information on the Hawaiian hoary bat to guide conservation efforts in support of recovering this species, the Service and DOFAW have approved wind energy-related HCPs that include a Hawaiian hoary bat research component as part of the mitigation program. The inclusion of a research-based mitigation measure for the Hawaiian hoary bat in HCPs is consistent with the findings presented in the *Endangered Species Recovery Committee Hawaiian Hoary Bat Guidance* (Amlin and Siddiqi 2015). The document suggests that it may be appropriate to consider providing a mitigation credit of one Hawaiian hoary bat for each $50,000 of funding to be allocated for specific Hawaiian hoary bat research projects that are included in a proposed or amended HCP and assured of implementation by the applicant or permittee through a letter of credit or other financial assurances acceptable to the Service and DOFAW. Research is not proposed as part of the mitigation in this HCP. However, research from other projects will be used to inform actions and management decisions for the restoration project proposed in the HCP.

2.2.1.3.1. Lowland Mesic-Wet Ohia Forest Habitat Restoration

The 150,865-acre Kahuku Unit of Hawaii Volcanoes National Park (HVNP), acquired in 2003, provides habitat for a number of rare, threatened, and endangered species, including the Hawaiian hoary bat (Fraser and HaySmith 2009). However, much of the Kahuku Unit's lowland forest (at less than 1,372 m [4,500 feet] elevation) has been disturbed by cattle, sheep, and feral pig activity or converted to non-native grass pastures. The National Park Service (NPS) at HVNP has developed a proposal to restore lowland forest within the Kahuku Unit, with a focus on invasive plant control and planting of native trees (Appendix D of the HCP; SWCA 2017). Lalamilo proposes to partially mitigate the requested take by funding these actions.

In brief, HVNP plans to restore 90 acres of degraded forest/pasture in the Kahuku unit. Currently, HVNP staff are constructing boundary fences and removing animals, but additional measures, such as invasive plant control and planting of native trees, are needed to facilitate forest recovery and restoration of wildlife habitat. These additional measures proposed are beyond the scope of HVNP funds and would not be conducted without private funding (Rhonda Loh, HVNP, personal communication, March 15, 2017).

Objectives of the restoration are as follows:

1. Prevent establishment of target weed species to promote natural native plant establishment in 90 acres.

2. Plant an average of 80 nursery-reared seedlings per 1 acre, for a total of 7,200 seedlings and broadcast an average of 10,000 seeds of native species per 1 acre for a total of 900,000 seeds to facilitate forest recovery in former pasture in the Kahuku Unit.

3. Every 5 years, evaluate and submit a report on community vegetation changes within and outside of the active restoration area.

The methods of the restoration are as follows:

1. Prevent establishment of target weed species. HVNP work crews would conduct ground searches to locate and target weed species throughout the mitigation area. Global positioning system (GPS) data would be collected for areas searched and number of plants treated. Target species would include blackberry (*Rubus discolor*), strawberry guava, kahili ginger, and christmasberry. Control methods would follow established park prescribed treatments for each species. Control would be carried out three times every year during the mitigation period.

2. Seeds of native tree and shrub species would be collected in the local area and processed for propagation. All propagation would be conducted at the HVNP native plant facility. Facilities would be kept free of pest species; individuals would be rigorously monitored and sanitized before planting to avoid contamination of target locations. Techniques for propagating and planting common native species have been developed and applied at HVNP. Before planting and seed broadcasting, alien grasses would be temporarily suppressed by applying a 2% solution of imazapyr and glyphosate. Planting and seeding would be strategically placed to link existing forest fragments or existing solitary trees throughout the mitigation area.

3. Monitor project success. Vegetation monitoring plots would be established both within and outside of the Project Area to evaluate impacts of management actions on the vegetation community composition and structure. Plots would be established in the first year of the project and re-surveyed at 5 and 10 years.

The project would be implemented according to the following schedule:

1. Year 1: Begin project coordination and site visits with work leaders. Begin collection of plant material and propagation. Establish monitoring plots.

2. Year 2–5: Begin planting of nursery reared seedlings. Complete planting of roughly half of the planned seedlings by year 5. Broadcast half of the seeds. Assess success criteria at monitoring plots at year 5. Conduct invasive plant sweeps and removal at year 2 and 5.

3. Year 6–10: Complete planting of the remaining half of the nursery reared seedlings. Broadcast the remaining half of the seeds. Conduct invasive plant sweeps and removal at year 8. Re-assess monitoring plots at year 10.

The restoration component would be completed in partnership with HVNP. Lalamilo would assure restoration commensurate with the level of take, as described in this section. HVNP would be responsible to conduct all work and monitoring described in this section.

USFWS requires that the habitat restoration project also include a bat monitoring component (D. Sether, USFWS, pers comm 08/17/2015). Three acoustic bat detectors (one every 30 acres) would be placed within the forest restoration area to document call frequency as an index of Hawaiian hoary bat activity levels. This monitoring would occur prior to (Year 1), and during (Year 2) the habitat restoration for a one-year period, and again at year 6, 11, and 20.

If Tier 2 take levels are triggered, additional habitat restoration similar to that described above and valued at an additional $150,000, would be implemented. It would consist of forest restoration of an additional 90 acres in the Kahuku unit of HVNP, which would proceed on a schedule identical to that defined above. The mitigation success criteria and adaptive management triggers would be identical to those defined for Tier 1. The No Surprises clause would not apply if the Tier 2 mitigation were to change or be modified under adaptive management because of new information about the bats or habitat needs.

2.2.1.3.2. Success Criteria

The Applicant would provide funding for the required conservation (monitoring, minimization, and mitigation) measures in full, even if the actual costs are greater than anticipated.

Mitigation for each tier of Hawaiian hoary bat take would be considered successful when the following items have been completed.

- Habitat restoration of 90 acres of degraded forest/pasture would be restored within the Kahuku unit of HVNP, according to the amounts and schedules provided in Appendix A of the HCP (SWCA 2017). Success would be achieved when the following are completed:
    - 90 acres would be swept for control of target weed species according to established park-prescribed treatments to promote natural native plant establishment.
    - An average of 80 nursery-reared seedlings per 1 acre, would be planted for a total of 7,200 seedlings and broadcast an average of 10,000 seeds of native species per 1 acre for a total of 900,000 seeds to facilitate forest recovery in former pasture in the Kahuku Unit.
- Vegetation monitoring plots would be established within and outside of the restoration area to evaluate impacts of management actions on the vegetation community composition and structure. Plots would be established in the first year of the project and assessed at 6 and 11 years. Each plot would measure 20 meters by 30 meters. Restoration would be considered successful when assessment of the vegetation monitoring plots result in the following:

    - Outplanted seedling survival averages 60% across all outplanted species at one year post planting.
    - Native species richness significantly increases over time.
    - The canopy is composed entirely of native tree species.
- A report would be submitted on community vegetation changes within and outside of the active restoration area every five years. This report would serve as the basis to determine whether adaptive management actions are warranted.
- Status and results of the restoration efforts applicable (including expenses) to the appropriate tier are provided in annual reports to DOFAW and USFWS.

The requested take of three bats in Tier 1 will be fully mitigated by the restoration of 90 acres of habitat in HVNP that will be permanently protected. The restoration site is within the known range of the Hawaiian hoary bat. The methods used by the National Park Service to achieve this restoration are reliable in that the functional bat habitat is reasonably certain to be improved within the first 2-5 years through removal of invasive plants and improvement of foraging quality for the bats. Long-term roosting and potential pupping resources are expected to be established within 15-20 years. The size of this restoration project is likely to fully offset the take of at least three bats. This is based on the conservative assumption that the average life span of a Hawaiian hoary bat is 10 years and that the core use of an adult male bat is 40 acres. Females can and do overlap in the use of areas, and multiple female bats have been observed occupying the same tree simultaneously while raising pups. Accordingly, over a 20 year period, a 40 acre restored parcel would provide habitat for at least two adult male bats, multiple female bats, plus bat pups. The maximum number of bats that could be supported by this 90 acre restoration project is unknown. The 90 acre restoration project area currently supports low-value bat habitat, because there are no trees large enough for roosting and the invasive plant species do not support the arthropods on which the Hawaiian hoary bats routinely forage. It is likely that bats simply travel through the proposed mitigation project area *en* route to higher quality areas. Once high quality habitat is created, the mitigation site will provide long-term, forested habitat comprised mostly of native species for roosting, potential pupping, and forest edge foraging habitat for bats. These enhancements will provide resources that positively affect the productivity of Hawaiian hoary bats. For these reasons, the availability and expected use of the parcel of functional Hawaiian hoary bat habitat that is large enough to support at least four adult bats plus pups over the next 20 years, is likely to fully offset the impacts of taking three Hawaiian hoary bats by the covered activities under the HCP. But for the mitigation action, this 90 acre parcel of habitat is not likely to provide functional bat habitat. Therefore, the habitat created by the restoration project is of greater value and fully offsets the take of three bats over the 20 year operational term. If Tier 2 is reached, the additional take of three bats will be mitigated through funding an additional 90 acres of restoration in the Kahuku unit of HVNP. The restoration project will be informed by the monitoring and ongoing bat research and maybe modified to ensure actions are fulfilling the bats biological needs.

2.2.1.3.3. Adaptive Management Trigger

A report would be submitted following Years 6 and 11 of the mitigation project (every 5 years following commencement of restoration) that would analyze whether the vegetation monitoring plots are satisfactorily moving toward success, as defined in the mitigation success criteria (see Section 2.2.1.3.2). Adaptive management actions would be taken if the Service determines the success criteria would not be achieved. Adaptive management actions may consist of re-applying herbicide, re-broadcasting seed, outplanting additional individuals, or other actions necessary to achieve the success criteria. The specific mitigation actions may also be modified by the Service based on the results of ongoing bat monitoring and research to maximize benefit to the bat and other protected species utilizing the restoration area.

2.2.1.4. HAWAIIAN PETREL

Proposed mitigation measures for the Hawaiian petrel center around the largest active Hawaiian petrel colony, which has an estimated 100 to 200 breeding pairs and is located in HVNP on Mauna Loa. This colony currently provides the only opportunity to implement conservation measures to benefit this species. The proposed mitigation project would only be implemented with a contribution of private funds and would not take place otherwise (pers. comm., Rhonda Loh, HVNP, March 17, 2017). The mitigation activities and success criteria would be specific to the Lalamilo Project and the mitigation activities of other projects that could occur in the future at or near this site would not be used for Lalamilo mitigation credit.

2.2.1.4.1. Predator Control

The Hawaii Volcanoes National Park (HVNP) has developed a specific proposal to protect the largest subcolony of nesting Hawaiian petrels on the Island of Hawaii, which is located on Mauna Loa in HVNP. The colony when unfenced and unprotected from cats, suffered approximately 26 known fatalities as a result of cat predation over a time period of 18 years (Rhonda Loh, HVNP, personal communication, June 30, 2014). In 2016, a 5-mile long fence equipped with anti-strike materials was completed that protects 259 ha (640 acres) of nesting that habitat. This fenced Project area contains approximately 45 active nests (Rhonda Loh, HVNP, personal communication, June 30, 2014) and numerous additional burrow sites for future expansion of the subcolony. Lalamilo would provide funds to the HVNP to survey for and remove predators found inside the fenced area until predators are below detection. In this case, a taken Hawaiian petrel adult may be replaced through increased survival rates of adults in the area or adults may be replaced by fledglings based on an equivalency standard agreed upon by the Service and DOFAW. Lalamilo would fund two years of intense monitoring and predator removal (Years 1 and 2 of mitigation project) and an additional pulse of monitoring and predator removal after 5 years have passed (Year 7 of mitigation project). Effectiveness monitoring would be conducted by HVNP using standard NPS monitoring procedures and the outcomes reviewed by the wildlife agencies. Changes necessary to meet Lalamilo's success criteria and mitigation obligations would be implemented through adaptive management and best science available. Funding details are included in Appendix A of the HCP.

The mitigation project is expected to represent mitigation commensurate with or greater than the impact of the taking because it is expected that more individuals would be relieved from predation than would be taken as a result of the Lalamilo Project. If mitigation credit, based on the success criteria falls short of what is required to fulfill statutory requirements, Lalamilo would implement additional mitigation at the site as part of adaptive management.

2.2.1.4.2. Success Criteria

Ongoing Project monitoring by HVNP would be used to assess mitigation effectiveness over time. Success of mitigation measures may be measured by a reduction in observed mortality at the colony or increased productivity (average number of fledglings per pair) at the release site over baseline levels. Baseline levels would be obtained from a mitigation site with existing baseline data or would be based on best available scientific data. If the mitigation credit falls short of what is required to fulfill statutory requirements, additional mitigation would be implemented at the site as part of adaptive management. Mitigation for the Hawaiian petrel would be considered successful when the following items have been completed.

- HVNP completes predator monitoring and removal inside an existing predator-proof fence for three years (Years 1, 2, and 7 of the mitigation project) and standard HVNP methods show a reduction in predators that are below detection levels.

- Annual reports detailing mitigation activities and effectiveness are provided to USFWS and DLNR.

2.2.1.4.3. Adaptive Management Trigger

Adaptive management would be triggered if the results of Years 2 or 7 of trapping indicate that reducing predators below detection levels is unattainable.

2.2.2. Monitoring and Reporting

The Service advises that HCP monitoring programs address both compliance monitoring and effectiveness monitoring (U.S. Fish and Wildlife Service 2000). A summary of proposed monitoring and reporting efforts is presented in Table 4. Compliance monitoring would verify the implementation of the HCP terms and conditions, and effectiveness monitoring would be undertaken to assess the effectiveness of the HCP's minimization and mitigation measures toward meeting the biological goals and objectives described in Section 8 of the HCP (SWCA 2017). A detailed description of monitoring and reporting efforts associated with the Project can be found in Section 10.2 of the HCP (SWCA 2017).

Table 4. Summary of Monitoring and Reporting Efforts

Compliance Monitoring
Fatality monitoring of the site would be conducted weekly in ITP intensive monitoring years 1, 2, 5, 10, and 20. However, the frequency of monitoring can be increased as an adaptive management measure if carcass retention rates are lower than anticipated. Carcass retention (CARE) and searcher efficiency (SEEF) trials would be carried out each intensive monitoring year. During interim years, fatality monitoring, SEEF, and CARE trials would be performed on a schedule developed through adaptive monitoring and upon approval from the Service and DOFAW. To maximize a searcher's ability to spot carcasses, particularly those of small bats, the vegetation in the monitoring plots would be maintained short through continued grazing by cattle and goats.
Effectiveness Monitoring
Petrel burrows will be monitored at 5 year intervals to evaluate the number of active burrows and reproductive success in the fenced area. This would be compared to the baseline data collected by the NPS at HVNP to date to determine the success of the mitigation measures. For the Hawaiian hoary bat habitat restoration, HVNP would monitor success of invasive species control and native plant establishment.
Reporting
Annual reports summarizing all Project activities would be submitted by the Applicant to the DLNR and the Service. These reports would describe the results of compliance (e.g., fatality) and effectiveness monitoring, including 1) actual frequency of monitoring of individual search plots; 2) results of SEEF and CARE trials with recommended statistical analyses, if any; 3) directly observed and adjusted levels of incidental take for each species; 4) whether there is a need to modify the mitigation for subsequent years; 5) the efficacy of monitoring protocols and whether the monitoring protocols need to be revised; 6) results of mitigation efforts conducted; 7) recommended changes to mitigation efforts, if any; 8) budget and implementation schedule for the upcoming year; and 9) continued evidence of the Applicant's ability to fulfill funding obligations.

After review of the annual monitoring report and in cooperation with DOFAW and the Service, or if the need for adaptive management becomes otherwise evident, the Applicant would implement adaptive management changes recommended by the DLNR and the Service to the measures described in the HCP to meet the biological objectives for the covered species.

2.2.3. Funding

The Applicant would provide funding for the required conservation (monitoring, minimization, and mitigation, adaptive management to achieve effectiveness targets, and implementation of changed circumstances) measures in full, even if the actual costs are greater than anticipated. The cost for mitigating incidental take of the Hawaiian hoary bat has been estimated by DOFAW as $50,000 per bat take, as discussed in the Hawaiian Hoary Bat Guidance Document (Amlin & Siddiqi 2015). Cost

estimates are provided in Table 5. Details on how this funding for conservation measures offsets the impacts to bats are discussed under Section 2.2.1.3 and Section 2.2.1.4 for the Hawaiian petrel.

Cost estimates provided in Table 5 are an estimate for which financial assurance is provided. Annual payments, as presented in Appendix A of the HCP, will meet NPS funding requirements and ensure the mitigation projects are continually funded. In the case that Tier 2 forest restoration mitigation project will begin and the Tier 1 forest restoration will continue on the proposed 10-year timeline. The actual financial instrument between NPS at HNVP and the Applicant is subject to agreement by those entities. The Applicant would be obligated to fulfill their mitigation obligations fully, but alternative amounts and schedules would be subject to the final agreement between NPS at HNVP and the Applicant.

In Hawaii, all wind facilities that currently hold incidental take permits are currently deploying curtailment and feathering of the turbine blades during periods of low wind speed at night to minimize the number of bat fatalities. This action reduces renewable power output but is expected to significantly lower the incidental take of the bats and other nocturnally active species in the future (Arnett et al. 2013b, 2016, Erickson et al. 2014). Because the efficacy of curtailment and feathering of the blades is variable, the total take projections do not account for the expected reduction from curtailment and feathering, thus projections for some projects may be above the actual number of fatalities likely to occur. In order to manage this uncertainty, projects requesting take may use up to three tiers to divide the requested take into smaller allotments, called tiers. A permittee would be required to mitigate fully for the tier they are in, and furthermore, would be expected to develop a plan for the next tier of mitigation and provide funding assurances when the estimated take reaches 66-75% of the current tier. Approved Projects with ITPs would be expected to implement the next tier of Service and DOFAW approved mitigation prior to, or at the time of, reaching the next tier. This ensures that the take level authorized under an ITP would be mitigated for in advance of the take. A project that has less take than projected can request a reduction in the amount of take authorized, provided the project has not entered that tier.

Funding assurances are required to remain in compliance with the ITP/ITL. As described above, the Lalamilo project uses two tiers and funding assurances would be required for the second tier when 66% (2 bats) of Tier 1 has been reached. Take estimation would be based on Evidence of Absence software informed by compliance monitoring and the software output at the 80% credibility level. The effective date for the next tier of take authorization would be dependent on submission of proof of that tier's funding assurance in a form that is acceptable to the Service and DLNR. The Applicant would be considered out of compliance and subject to suspension of their permit or other federal enforcement action if this is not provided when the next tier is reached. All Year 1 mitigation costs, estimated at $107,333, will be funded upon issuance of the ITP/ITL. A letter of credit or other similar instrument satisfactory to both FWS and DLNR naming the DLNR as beneficiary will secure remaining mitigation for the Hawaiian hoary bat ($135,000) and Hawaiian petrel ($74,667), compliance monitoring ($320,000), and contingency expenses for Tier 1 ($52,967), with an estimated total value of $582,634 (Table 5). The letter of credit will be renewed on an annual basis based on the outstanding mitigation cost at the start of the following year. Tier 2 mitigation will be initiated and the funding assurance put into place if more than 66% of Tier 1 bat take (2 bats) occurs during the life of the permit. The purpose of the letter of credit will be to secure the necessary funds to cover any remaining mitigation and monitoring measures in the unlikely event that there is unmet mitigation for any reason.

Table 5. Funding for Proposed Action Conservation Measures

Category	Tier	Item	Expense ($)	Number of Payments (over the permit term)	20-Year Total ($)	Timing of Expense
Compliance		Compliance monitoring weekly	45,000	5	225,000	Once per year in payment year
		Compliance monitoring bi-weekly	10,000	15	150,000	Once per year in payment year
Hawaiian Hoary Bat	Tier 1	Habitat restoration at HVNP Kahuku Unit	15,000	10	150,000	Once per year in payment year
	Tier 2	Additional habitat restoration at HVNP Kahuku Unit	15,000	10	150,000	Once per year in payment year
Hawaiian Petrel		Colony Protection at HNVP	37,333	3	112,000	Once per year in payment year
Contingency Fund	Tier 1	Inflation, adaptive management changes, other changed circumstances	52,967	-	56,967	On reserve if needed; based on 10% of contributions Years 2-20
	Tier 2	Inflation, adaptive management changes, other changed circumstances	15,000	-	15,000	On reserve if needed; based on 10% of Tier 2 mitigation
				Compliance monitoring	**$375,000**	
				Tier 1 mitigation (all species)	**$262,000**	
				Tier 2 mitigation (bats)	**$150,000**	
				Tier 1–2 Mitigation	**$412,000**	
				Total	**$787,000**	

2.2.4. Adaptive Management and the Amendment Process

Per Service policy (see 65 *Federal Register* 35242 [June 1, 2000]), adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when it is determined that doing so would be appropriate in maintaining compliance with the terms and conditions of an ITP and ITL.

Data resulting from compliance (i.e., fatality) and effectiveness (mitigation) monitoring may indicate the need for adaptive management. The Applicant would meet at least semi-annually with USFWS and DLNR. Additional meetings may be requested by the wildlife agencies at any time to address immediate questions or concerns. The purpose of the regular meetings would be to evaluate the efficacy of monitoring methods, compare the results of monitoring to the estimated take, evaluate the success of mitigation, and develop recommendations for future monitoring and mitigation. Regular meetings would also provide opportunities to consider the need for adaptive management measures. The Applicant shall

implement specific adaptive management measures if such measures are determined to be necessary and appropriate by the USFWS and DLNR to achieve the conservation benefits of the mitigation plan. In addition, the Applicant would meet annually with the ESRC to provide updates of monitoring, mitigation, and adaptive management, and to solicit input and recommendations for future efforts.

After review of the annual monitoring report and in cooperation with DLNR and the Service, or if the need for adaptive management becomes otherwise evident, the Applicant would implement adaptive management changes, approved by the Service and DLNR, to measures described in this HCP to meet the biological objectives described in this HCP.

Adaptive management would also respond to relevant new information or technologies that may become available in the future. This may include the deployment of bat deterrent technology (Arnett et al. 2013a, 2016, Hein et al. 2015, Sinclair et al. 2016). Deterrent technology is currently under development locally and elsewhere and is not expected to be commercially available in the next decade. Because of the unknowns surrounding commercial availability and efficacy in Hawaii, the incidental take projections do not consider the reduction in take that would be expected in the future if effective deterrent technology becomes available for deployment locally. The incentive for a Project to implement the technology would largely be based on the Permittee's willingness to reduce or eliminate future take of bats and the associated compensatory mitigation for that take that would be avoided if deterrent technology is fully implemented and successful. At the present time, deterrents are recognized by the Service as avoidance and minimization measures, and deployment of the future technology when it becomes available is recommended.

2.3. Alternative 3 (No Curtailment Alternative)

Under this alternative, the Project would not feather or curtail during lower wind speeds. No curtailment means that the turbines would be operating in lower wind speeds between dusk to dawn periods and that all five turbines could potentially be operating simultaneously. This would increase the generation of renewable energy and decrease reliance on fossil fuels during periods of lower wind speeds. No curtailment of the turbines during periods of low wind speeds is expected to provide the power necessary to operate the water well pumps and would require less reliance on another type of energy source from dusk to dawn periods, such as fossil fuels. Under low wind conditions, all five turbines would likely be operating simultaneously in order to provide the necessary power during periods of low winds unless power is supplemented. This alternative also results in an increase in the time during which the turbine blades would be rotational, particularly at lower wind speeds, and would present a greater risk of collision-related mortality.

The Applicant would continue to implement the avoidance and minimization measures described in the No Action Alternative during Project testing, operation, and maintenance to avoid or minimize impact to Covered Species and other wildlife species (see Section 2.1.1) except that up to five turbines could be operational during periods of low wind in order to provide adequate energy for the pumps. This Alternative is likely to increase take. Compensatory mitigation measures would likely need to be increased commensurate with the increase in take associated with the increased operating time.

2.4. Alternative 4 (Increased Cut-in Speed)

Alternative 4 consists of implementing year-round low wind speed curtailment and blade feathering and increasing the cut-in speed from 5.5 m/s, the current cut-in speed proposed by the Applicant, to 6.5 m/s. Under this alternative, the turbines would be curtailed and blades feathered until wind speeds of at least 6.5 m/s were sustained for 10 minutes. Like the proposed alternative, the increased cut-in speed alternative would be implemented year-round from 1 hour before dusk until 1 hour after dawn. As was

briefly described in Section 2.2.1.1., the actual benefits to bats of increasing the cut-in speed from 5.5m/s to 6.5 m/s year-round are not proven in Hawaii (see Section 3.4.1.1.4 for a discussion on this uncertainty). This alternative would likely to reduce renewable power production and increase dependence on fossil fuels to operate the water well pumps. In addition, increased cut-in speeds would likely reduce total renewable-based power production below the minimum level required by the Applicant's purchase power agreement (PPA), resulting in an economically unviable project. This alternative would provide diminishing returns. However, because of the uncertainty this alternative is being carried forward in the EA.

2.5. Alternatives Considered But Not Fully Analyzed

Service-considered alternatives that were not carried forward for analysis are described in Table 6.

Table 6. Alternatives Eliminated from Further Analysis

Alternatives Considered	Reason for Eliminating from Further Analysis
Issuance of a Section 10(a)(1)(B) Incidental Take Permit with Reduced 5-year Permit Term	The Service considered an alternative that would result in the issuance of an ITP and approval of the amended HCP as described in the Proposed Action, but with a reduced permit duration of 5 years. This alternative would potentially reduce take of the covered species because of the shorter term of operation. This alternative would not be compatible with the Applicants existing contract to provide power to the pumps for 20 years. This alternative is not considered reasonable and is not carried forward for consideration in this EA.
Alternative Types of Renewable Energy	The DWS's intent in proposing this Project was to reduce energy costs for water customers by replacing a large portion of its pumping energy demands with renewable wind energy at a discounted rate, as compared with current Hawaii Electric Light (HELCO) rates. There were a number of other types of renewable energy technologies that could be considered for powering the DWS's wells including geothermal, pumped-storage hydroelectric, and solar. However, these sources were considered infeasible due to the lack of resource (i.e., insufficient geothermal in the South Kohala region); inadequate available or controlled land area (i.e., not enough water storage capacity for pumped-storage hydroelectric) or space required for the quantity of solar panels necessary to meet generation needs of the Project; or excessive capital costs to develop, construct, and operate (i.e., pumped-storage hydroelectric and solar) separately or in addition to the existing wind farm In December 2009, the National Renewable Energy Laboratory (NREL) under the U.S. Department of Energy (DOE) conducted a preliminary analysis for repowering the original Lalamilo Wind Farm by replacing the original 120 Jacobs wind turbines with modern technology. The wind farm site is categorized by the DOE as a Class 7 "Optimal" wind resource, which is the highest classification for a wind energy project. Additionally, some of the facilities and infrastructure from the original wind farm, which could be used for a repowered wind farm, were left in place after decommissioning the site in 2010. These included an office building/workshop, power poles, power transmission lines, conduits, radio towers, and internal access roads. Thus, in light of the DOE's classification of the wind resource in the Project Area as optimal for a wind farm and in light of the historical use of the site as a wind farm, alternative forms of renewable energy were eliminated from further consideration. Because the project is already constructed, this alternative is not carried forward for further analysis.
Larger or Smaller Wind Projects	The Project is intended to produce an amount of energy roughly equivalent to the original Lalamilo Wind Farm. The preliminary analysis conducted by NREL (NREL 2009) was performed to assess the technical economic viability of a project. The analysis used the Micropower Optimization Model HOMER to optimize the capacity of wind power that would yield the lowest Levelized Cost of Energy for the DWS. The analysis concluded that the 120 original Jacobs turbines could be replaced by 1–10 modern turbines, depending on the technology and unit size selected. The Project would result in 3.3 MW of generation capacity from five turbines. A smaller project would not provide as much of an economic benefit for the DWS and would not meet the purpose of, and need for the Project, or the Project's goals for percent of fossil-fuel generated energy usage with renewable energy. A larger project would exceed the current load demand of the existing Lalamilo-Parker pumps, and because HELCO cannot currently accept any as-available energy to the grid if the amount of wind energy generated exceeds the amount of energy required by the pumps, there is no benefit to the owner/operator of the wind farm to offset capital costs for more generation capacity. Therefore, smaller or larger projects were eliminated from further consideration at this time.

3. CHAPTER 3: AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

3.1. Introduction

This chapter describes and analyzes the biological resources that would be affected under the No Action Alternative and action alternatives. Only those resources raised as issues of concern are considered below (see Section 1.6, Scope of Environmental Assessment). For the purposes of this EA, existing conditions are described for a 2,404-acre Project area. This area consists of all project components (turbine string, access roads, and tie-lines, etc.) that would remain in operation under all alternatives as well as a 0.5-mile buffer on either side of components where resources could be exposed to noise and human disturbance (Figure 3).

3.2. General Setting of the Project Area

The Project is located on the lower (western) flank of the Mauna Kea volcano, between Waimea and Waikoloa Village, Hawaii. A detailed description of the Project's environmental, cultural, and social setting can be found in the 2014 *Lalamilo Wind Farm Repowering Project Environmental Assessment* (Tetra Tech 2014).

The Project area is surrounded on all sides by agricultural pastoral lands principally used for cattle (*Bos taurus*) grazing. Vegetation in the Project area consists of heavily disturbed, dry grassland. Fountain grass (*Pennisetum setaceum*) and buffelgrass (*Cenchrus ciliaris*) are the dominant species, both of which are non-native, aggressive, introduced grasses. Isolated or small groups of introduced kiawe trees (*Prosopis pallida*), klu (*Acacia farnesiana*), and koa haole (*Leucaena leucocephala*) are also broadly distributed along the access road and gulches (Tetra Tech 2014).

The topography of the Project area consists of a relatively flat plateau that slopes downward to the west and north. Elevations range from 427 m (1,401 feet) to 349 m (1,145 feet) above mean sea level (amsl) with an average slope of 5%. Several small dry gulches score the landscape around the west and north portions of the Project area (SWCA 2017).

The Project area soil is classified as Hāpuna-Waikui-Lalamilo complex, 0%–20% slopes. This soil series is a well-drained, stony soil that formed from basic volcanic ash over ʻaʻā lava and alluvium over basic volcanic ash (Natural Resources Conservation Service [NRCS] 2014).With respect to hydrology, the Project area is within the boundaries of the Island of Hawaii Waimea aquifer (Aquifer Code 8030; State of Hawaii Commission on Water Resource Management 2008). There are no perennial streams, intermittent streams, or wetlands in the Project area (National Hydrography Dataset [NHD] 2014; U.S. Fish and Wildlife Service 2014).

Average annual precipitation recorded at the Waikoloa Station southwest of the Project area is approximately 33.5 cm (13.2 inches) and is approximately 39.8 cm (15.7 inches) at the Parker Ranch Range 1 Station located northeast of the Project area (Giambelluca et al. 2013). Most rainfall occurs between October and March of each year. Average annual temperatures in the region range from a low of 63.8 degrees Fahrenheit to a maximum of 86.8 degrees Fahrenheit (Western Regional Climate Center 2015).

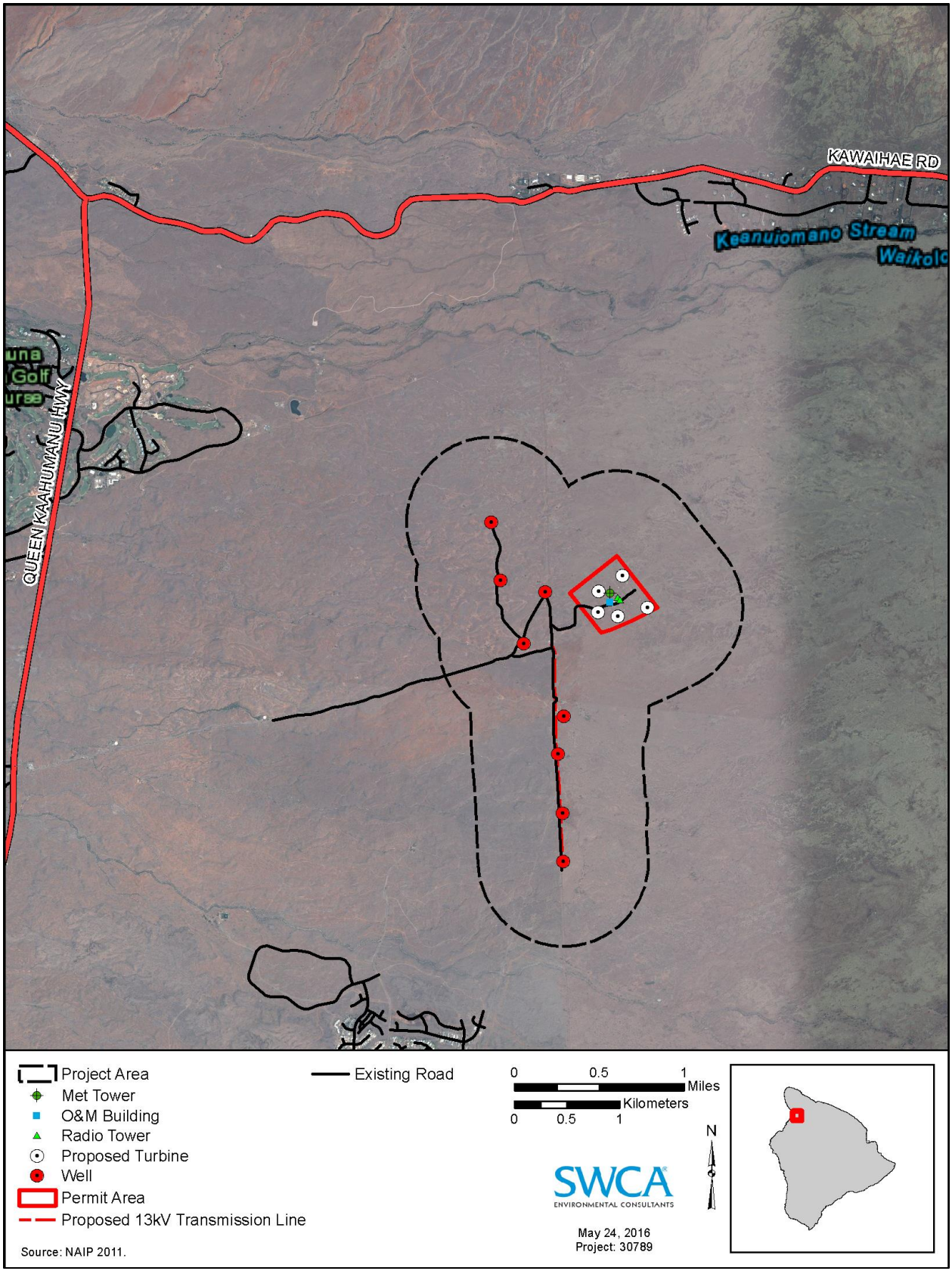


Figure 3. Project area for the Environmental Assessment.

3.3. Affected Environment

3.3.1. Covered Species

3.3.1.1. HAWAIIAN HOARY BAT

3.3.1.1.1. Population, Biology, and Distribution

The Hawaiian hoary bat is the only native land mammal present in the Hawaiian archipelago. It is a sub-species of the hoary bat (*Lasiurus cinereus*), which occurs across much of North and South America. The bat was listed in 1970 due to a perceived decline in numbers over the past 100 or so years, as a result of habitat loss (USFWS 1970, 1998). Both males and females have a wingspan of approximately 0.3 m (1 foot). The Hawaiian hoary bat's weight ranges from 12 to 22 g, and females are typically larger than males. The Hawaiian hoary bat has two varieties of fur color, the normal "hoary" whitish frosting and an alternative reddish hue (Todd 2012). Recent comparative genetic analyses of a limited number of specimens from the State of Hawaii and around the world suggests that there may have been at least two temporally-distinct introductions of the hoary bat into the Hawaiian islands and that the population may be composed of two emerging species, though this is only based on very preliminary data (Russell et al. 2015).

The Hawaiian hoary bat has been recorded on Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii, but no historical population estimates exist for this subspecies. It is suspected that breeding primarily occurs between April and August (Menard 2001). Females give birth to as many as two young (U.S. Fish and Wildlife Service 1998). Lactating females have been documented from June to September, indicating that this is the period when non-volant young are most likely to be present (Todd 2012). Until weaning, young are completely dependent on the female for survival. Hawaiian hoary bat activity varies seasonally, and most observations have occurred between sea level and 2,286 m (7,500 feet), although bats have been seen as high as 4,023 m (13,200 feet) (U.S. Fish and Wildlife Service 1998). On the Island of Hawaii, research indicates that bats concentrate in coastal lowlands from April through October (Todd 2012) and in interior highlands from November through March (Gorressen et al. 2013). The bat is also common in three sites of northwest Kauai (C. Pinzari, pers. comm. 2011, cited in USFWS 2011) and occurs in the Kahikinui Forest Reserve and adjoining Nakula Natural Area Reserve on Maui (Todd et al. 2016). Hawaiian hoary bats were also detected in the north Koolau mountains on Oahu, though the data indicate the spatial prevalence was low (Gorresen et al. 2015).

Hawaiian hoary bats roost in native and non-native vegetation from 1 to 9 m (3 to 29 feet) above ground level (agl). Bats have been observed roosting in ohia (*Metrosideros polymorpha*), hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), kiawe tree, avocado (*Persea americana*), mango (*Mangifera indica*), lychee (*Litchi chinensis*), ironwood (*Casuarina equisetifolia*), shower trees (*Cassia javanica*), pūkiawe (*Styphelia tameiameiae*), and fern clumps. Bats are also suspected to roost in eucalyptus (*Eucalyptus* spp.) and Sugi pine (*Cryptomeria japonica*) stands. While roosting during the day, Hawaiian hoary bats are solitary, although mothers and pups roost together (U.S. Fish and Wildlife Service 1998).

Hawaiian hoary bats feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). They appear to prefer moths ranging from 16 to 20 mm (0.60 to 0.89 inch) (Bellwood and Fullard 1984; Fullard 2001). Koa moths (*Scotorythra paludicola*), which are endemic to the Hawaiian Islands and use koa (*Acacia koa*) as a host plant (Haines et al. 2009), are frequently targeted as a food source (Gorresen et al. 2013). Prey is located using echolocation. Water courses and edges (e.g., coastlines and forest/pasture boundaries) appear to be

important foraging areas. However, Hawaiian hoary bats also use a wide range of other habitats, including barren volcano craters and lava fields, cropland, developed golf courses, urban areas, suburban or rural yards and roads, forests (eucalyptus plantations, *albizia* spp.–dominant forest, ohia-dominant forest, koa-dominant forest, and mamane-naio forest), pastureland, and rangeland (Uyehara and Wiles 2009). In addition, the species is attracted to insects that congregate near lights (Bellwood and Fullard 1984; DLNR 2015; U.S. Fish and Wildlife Service 1998). They begin foraging either just before or after sunset depending on the time of year (DLNR 2015; U.S. Fish and Wildlife Service 1998).

3.3.1.1.2. Current Threats

Possible threats to the Hawaiian hoary bat include pesticides (either directly or by affecting prey species), predation, alteration of prey availability due to the introduction of non-native insects or changes in plant hosts, climate change, roost disturbance (U.S. Fish and Wildlife Service 1998), snagging on barbed wire fences (Zimpfer and Bonaccorso 2010), and colliding with wind turbines. Management of the Hawaiian hoary bat is also limited by a lack of information on key roosting and foraging areas, food habits, seasonal movements, and reliable population estimates (U.S. Fish and Wildlife Service 1998).

In their North American range, hoary bats are known to be more susceptible to collision with wind turbines than are most other bat species (Erickson 2003; Johnson 2005; Johnson et al. 2000). Most mortality has been detected during the fall migration period. Hoary bats in Hawaii do not migrate in the traditional sense, although as indicated, some seasonal altitudinal movements occur. Currently, it is not known if Hawaiian hoary bats are equally susceptible to turbine collisions during their altitudinal migrations as hoary bats are during their migrations in the continental U.S. A total of 44 Hawaiian hoary bat fatalities have been observed at five ITP/ITL permitted wind farms in Hawaii (SWCA 2017: Table 7.1).

3.3.1.1.3. Occurrences in or near the Project Area

Based on a 1-year acoustic monitoring study conducted from July 2012 to June 2013, the Hawaiian hoary bat is known to occasionally use the area (Tetra Tech 2014). Results of this study suggest seasonal variability in bat presence, with, on average, 0.13 bat passes per recorder night identified. Recent research on Hawaiian hoary bats suggests that bats can use a variety of introduced and native vegetation for roosting, ranging from 1 to 9 m (3 to 29 feet) tall with dense foliage cover (DLNR 2015). Large trees are sparsely distributed in the Project area, though none have the dense foliage cover preferred by Hawaiian hoary bats. The Project area is only used by bats for foraging or in transit between foraging and roosting locations. No roosting occurs in the Project area.

3.3.1.1.4. Occurrences in or near the Mitigation Site

The Kahuku Unit at HVNP provides potential habitat for the Hawaiian hoary bats, which have been detected in a variety of forest habitats ranging from 609 m (2,000 feet) to 2,255 m (7,400 feet) in elevation (Fraser and Haysmith 2009). Fraser and Haysmith also reported that bats are active within the Kahuku Unit. Unfortunately, much of the lowland mesic-wet Ohia forest (<1,372 m [4,500 feet] in elevation is badly degraded by decades of land clearing and impacts by cattle, mouflon, and pigs. Large forest tracts have been converted to alien grass pastures with portions invaded by christmasberry (*Schinus terebinthifolius*) and incipient populations of strawberry guava (*Psidium cattleianum*) and kahili ginger (*Hedychium gardnerianum*) that are not utilized by the bats. Park staff are constructing boundary fences and removing feral animals, but additional measures, such as invasive plant control and planting of native trees, are needed to facilitate forest recovery and restoration of wildlife habitat. Without active restoration, much of the area would remain dominated by nonnative pasture grasses without native forest regeneration.

The Kahuku Unit of HVNP was acquired in 2003 for the preservation of habitat for threatened, endangered, and other rare plants and animals. To this end, HVNP fenced large tracts of land within this unit, and removed ungulates to reduce the immediate threat to the preservation of these rare species and their habitat. Outside funding, such as mitigation funds, would be necessary to implement restoration methods to improve the habitat for these rare species. HVNP is listed by NPS as the National Park with the second highest number of ESA-listed species. Restoration actions to address all of these species in the park would require considerable funds in addition to HVNP operating funds. This provides an opportunity for this mitigation program to contribute to conservation of multiple species, in an area with long-term preservation guarantees.

3.3.1.2. HAWAIIAN PETREL

3.3.1.2.1. Population, Biology, and Distribution

The Hawaiian petrel is a Pacific seabird with a dark gray head, wings, and tail, and a white forehead and belly. The bird averages 40 cm (16 inches) in length and has a wingspan of 0.9 m (3 feet) (U.S. Fish and Wildlife Service 2015).

The Hawaiian petrel was once abundant on all main Hawaiian Islands except Niihau (DLNR 2015). The population was most recently estimated to consist of approximately 20,000 individuals, with 4,000 to 5,000 breeding pairs (DLNR 2015). The once-significant breeding populations of Hawaiian petrels on the Island of Hawaii were reduced to very small numbers by the end of the twentieth century (Banko 1980; Conant 1980; Richardson and Woodside 1954). Today, Hawaiian petrels continue to breed in high-elevation colonies on Maui, Hawaii, Kauai, and Lanai (Richardson and Woodside 1954; Simons and Hodges 1998; Telfer et al. 1987). Radar studies conducted in 2002 suggest that breeding may also occur on Molokai (Day and Cooper 2002). The largest known breeding colony is at Haleakala National Park, Maui, where as many as 1,000 pairs have been thought to nest annually (DLNR 2015). An accurate population estimate for the Island of Hawaii is lacking; however, a rudimentary estimate suggests approximately 2,000 individuals (Cooper and Day 2004). HVNP currently has the largest active Hawaiian petrel colony on the Island of Hawaii Island with an estimated 100 to 200 breeding pairs (Pyle and Pyle 2009).

Hawaiian petrels are long-lived (approximately 30 years) and return to the same nesting burrows each year between March and April. The nesting season occurs between late February and November, with Hawaiian petrels accessing their underground burrows nocturnally (Simons 1985). Adult birds do not breed until age 6 and may not breed every year, but pre-breeding and non-breeding birds nevertheless return to socialize. Breeding females lay only one egg per year. Eggs hatch in June or July, and fledged young depart for the sea after approximately 4 to 5 months. Breeding and prospecting birds fly to the nesting site in the evening and leave for foraging trips before dawn.

Hawaiian petrels subsist primarily on squid, fish, and crustaceans caught near the sea surface. Foraging may take place thousands of kilometers from their nesting sites during both breeding and non-breeding seasons (Spear et al. 1995).

3.3.1.2.2. Current Threats

Hawaiian petrel fatalities have been documented at wind farms on Maui and are presumed to have occurred from collisions with turbines while birds are flying to or from their nesting colony (SWCA 2012). Mortality of Hawaiian petrels as a result of collisions with power lines, fences, and other structures near nesting colonies or from attraction to, or disorientation by, bright lights has also been documented (Ainley et al. 1997; Hays and Conant 2007; Mitchell et al. 2005). Other threats include predation by

introduced mammals (Hodges 1994; Simons 1985; Simons and Hodges 1998), habitat degradation, and disturbance of their breeding grounds. Non-native ungulates such as feral goats and pigs crush burrows and facilitate the establishment of invasive vegetation such as strawberry guava which can displace native vegetation and reduce the suitability of breeding sites (SWCA 2017).

3.3.1.2.3. Occurrence in and near the Project Area

HVNP currently encompasses the only known active Hawaiian petrel colonies on the Island of Hawaii (Judge et al. 2014). The three nearest colonies are located approximately 63 km (39.15 miles) from the Project area on the southeast flank of Mauna Loa, with one other known colony located approximately 89 km (55.3 miles) from the Project area on the southwest flank of Mauna Loa in the Kahuku section of the national park (Swift and Burt-Toland 2009). Although there is no known breeding colony on Kohala Mountain, petrels have been observed flying up Pololu and Waipio Valleys, which suggests that the species probably nests there (ABR, Inc. 2015).

Day et al. (2003) studied the movements and distribution of Hawaiian petrels and Newell's shearwaters on the Island of Hawaii using radar in 2001 and 2002. Because radar data do not identify passage rates by species and there are no recent records of nesting Newell's shearwaters on the Island of Hawaii, radar detections from Day et al. (2003) are understood to be primarily Hawaiian petrels. Movement rates of petrels on the island were generally low (0.0–3.2 targets per hour), with the exception of Waipio Valley. The timing of evening movements indicates that Hawaiian petrels fly over the north and south parts of the island. Birds flying over the Project area would therefore be expected to have a low target rate of approximately two targets per hour, similar to what was observed by Day et al. (2003). The Hawaiian petrel would only occur in the Project area in transit between the ocean and nesting grounds.

As discussed in Section 7.2.4 of the HCP (SWCA 2017), fall radar survey results from 2013 also detected radar images consistent with petrels or shearwaters (petrel/shearwater target), but no target was identified to species. During 5 days of surveys, this effort identified a daily passage of one to five landward-bound petrel/shearwater targets and zero to three seaward-bound petrel/shearwater targets. The timing of the detections, flight direction, and flight characteristics were consistent with Hawaiian petrel as well as the Newell's shearwater, but it is also possible that some or all of these detections were non-listed species exhibiting behavior consistent with listed seabirds. During 2015 summer surveys, a period during which the flight passage rates for nocturnal inland nesting seabirds including the Hawaiian petrel should be highest, no more than three radar targets that met criteria for petrel/shearwater-like targets were documented. All were headed in a seaward direction. Flight altitudes of these targets ranged from 184 to 366 m agl with a mean flight altitude of 284 ± 54 m agl (Tetra Tech 2014).

3.3.1.2.4. Occurrences in or near the Mitigation Site

HVNP currently has the largest active Hawaiian petrel colony on the Island of Hawaii Island with an estimated 100 to 200 breeding pairs, with no other known significant colonies on this island (Pyle and Pyle 2*009).* The colony, currently unprotected from cats, has suffered approximately 26 fatalities as a result of cat predation over a time period of 18 years (personal communication, Rhonda Loh, HVNP, June 30, 2014).

3.3.2. Non-Covered Species

The mixed grassland/shrubland vegetation in the Project area provides habitat for a range of other non-covered species, as well as endemic, indigenous, and migratory birds.

3.3.2.1. MIGRATORY AND NON-MIGRATORY BIRDS

Three MBTA-protected species are known to use the Project area: Pacific golden-plover, skylark, and house finch (*Carpodacus mexicanus*).

During fall nocturnal radar surveys, biologists observed daily patterns of approximately 10 Pacific golden-plovers flying in transit through the vicinity of the Project area (Tetra Tech 2014). Pacific golden-plovers occur in Hawaii from July through May and use a wide variety of habitats for foraging, including pastures on mountain slopes up to over 2,440 m (8,000 feet) elevation (Mitchell et al. 2005; Pyle and Pyle 2009). Preferred foraging areas include open habitat with plentiful insects. The skylark (an introduced species) frequents open ranchland habitats throughout the main Hawaiian Islands (Pyle and Pyle 2009) and is expected to be a permanent resident in and near the Project area. The house finch (a resident and introduced species) is a widespread species in the main Hawaiian Islands that frequents a variety of habitats, including ranchlands and grassland habitats. It may occasionally use the Project area, but is unlikely to nest there because of the absence of suitable trees (Pyle and Pyle 2009).

The Hawaiian short-eared owl (or pueo), another MBTA-protected species, was not detected during the biological reconnaissance survey (Tetra Tech 2014). However, the Hawaiian short-eared owl is a widespread resident species on the island of Hawaii where it is most common in open habitats such as grasslands, shrublands, and montane parklands (Mitchell et al. 2005; Pyle and Pyle 2009). The species preys on a wide variety of animals, including introduced small mammals, birds, and insects. The pueo may occasionally forage within the Project area but is unlikely to roost there because of the absence of suitable trees.

Two other introduced bird species—the African silverbill (*Lonchura cantans*) and chestnut-bellied sandgrouse (*Pterocles exustus*)—were detected during the biological reconnaissance survey and could nest in the Project area (Tetra Tech 2014). Other non-listed species could occur in the Project area. However, because there is limited vegetation suitable for foraging and nesting in the Project area, use of the area by other bird species is expected to consist only of occasional overflights.

3.3.2.2. OTHER SPECIES

Based on results from a biological reconnaissance survey, fauna in the Project area are scarce and dominated by non-native species (Tetra Tech 2014). Species detected during the biological reconnaissance survey included five introduced birds, an introduced mammal, and two insects (one introduced and one indigenous).

Domestic cattle were the only mammals observed in the Project area. However, other introduced species such as feral goat (*Capra hirca*), small Indian mongoose (*Herpestes auropunctatus*), cat (*Felis catus*), house mouse (*Mus musculus*), and rat (*Rattus* spp.) could also occur in the Project area. No reptiles or amphibians were observed during the surveys.

Two insect species were recorded in the Project area: the globe skimmer (*Pantala flavescens*), an indigenous dragonfly, and the introduced house fly (*Musca domestica*). These are both common and widespread species in the Hawaiian Islands (Tetra Tech 2014).

3.4. Potential Impacts and Mitigation Measures

3.4.1. Covered Species

3.4.1.1. HAWAIIAN HOARY BAT

3.4.1.1.1. Alternative 1 (No Action Alternative)

Under the No Action Alternative, all facility turbines would be nonoperational from approximately 1 hour before civil sunset until 1 hour after civil sunrise—i.e., completely curtailed at night. This alternative would likely reduce the risk of take to the Hawaiian hoary bat to at or below a negligible level and no ITP would be needed. Localized noise, lighting, and human or vehicle activity associated with current operation and maintenance tasks could displace or disturb bats using passive listening to forage (e.g., Schaub et al. 2008). Most of this activity would be intermittent and of short duration.

No effect to Hawaiian hoary bat roosting is anticipated from under the No Action Alternative because the Project area does not contain suitable roosting sites (Tetra Tech 2014). Per avoidance and minimization measures described in Section 2.1.1, trees taller than 4.5 m (15 feet) would also not be removed or trimmed during the pup-rearing season (June 1 to September 15) to avoid impacts to Hawaiian hoary bats.

If, in the future, a decision is made to decommission the project, all components would be removed and the site would be restored to pre-construction conditions. Because decommissioning activities would occur only in areas already cleared or disturbed, it is not anticipated that bats would be directly affected. Decommissioning activities could indirectly affect bats though temporary, localized noise and human or vehicular activity. These effects would be similar to those described above for operation and maintenance tasks. In the long term, project decommissioning would maintain or potentially improve Hawaiian hoary bat habitat through the restoration of preexisting vegetative communities.

Impacts of Avoidance and Minimization Measures

Under the No Action Alternative voluntary on-site minimization and avoidance measures would be implemented to help reduce the risk of bat take (see Section 2.1.1).

Based on these measures, combined with the predicted reduction in mortality to at or below a negligible level, no adverse population-level effects are anticipated for the Hawaiian hoary bat under the No Action Alternative. Without an approved HCP and subsequent ITP, the off-site mitigation measures described in the HCP and herein would not occur. The benefits to the species from habitat restoration efforts would not occur.

3.4.1.1.2. Alternative 2 (Proposed Action)

Based on post-construction bat fatality monitoring data collected at another operating wind farm on the Island of Maui—the Kaheawa Wind Power (KWP I) facility—it is estimated that between three and six bat fatalities could occur in the next 20 years under current Project operations (see Section 8.1.1 of the HCP for details). When an Applicant is preparing an HCP, the USFWS recommends that conservative estimates of take (i.e., greater than anticipated take levels) be developed, as appropriate, to account for uncertainty related to species biology, potential impacts, and the variability of the effectiveness of avoidance and minimization measures. This ensures that take levels authorized under the ITP are adequate to cover the Applicant's proposed actions and provide confidence that a major amendment to the HCP would not be needed during the permit term. It also ensures that the effect of the potential impacts

are fully disclosed and evaluated in accordance with NEPA and that the incidental take permitting requirements of section 10 of the ESA are satisfied. Although uncertainty about the overall statewide population size does not permit direct evaluation of this take significance, the most recent population indicators for the Hawaiian hoary bat indicate the species is present on all six of the major islands. Recent observations have shown that bats are also breeding on Oahu, where, previously, they had not believed to have been present. In a study conducted on the Island of Hawaii, from 2007 to 2011 the trend at some sites during periods of high detection probabilities were thought to be negligible (stable) to increasing. The analysis is suggestive but should not be construed as conclusive (Gorresen et al. 2013).

Assuming the population statewide is conservatively about 5000 bats (based on the best science available on the Hawaiian hoary bat distribution, habitat requirements, foraging behavior, previous incidental take and modeled fatality rates among other factors), the annual requested take requested by Lalamilo would represent approximately 0.006%. The proposed take estimates are based on the collision fatality risk of three turbines operating simultaneously and without implementation of the avoidance and minimization measures or low-wind speed curtailment. This action reduces power output but is expected to significantly lower the incidental take of the bats (Arnett et al. 2013b, 2016, Erickson et al. 2014). Therefore, with the addition of low-wind speed curtailment in the Proposed Action (discussed under Section 2.2.1.1) actual take may be reduced below the requested take of bats, though the Service is analyzing the full take of six bats over the proposed 20 year operational period.

As with the no action alternative localized noise, lighting, and human or vehicle activity associated with current operation and maintenance tasks could displace or disturb bats using passive listening to forage (e.g., Schaub et al. 2008). Most of this activity would be intermittent and of short duration, with the exception of continuous turbine operation, which would generally be limited to three or fewer turbines at any one time. Any displaced foraging bats would be required to expend additional energy to move to a new location, and could be at risk for predation. However, recorded levels of bat activity in the Project area are low (0.13 bat passes per recorder night; DLNR 2015). Additionally, foraging habitat is prevalent within the HVNP (approximately 150,865 acres); therefore, bats would not be precluded from using local habitat. A portion of the HVNP habitat is also slated for restoration efforts as part of the mitigation measures to offset the incidental take of the hoary bat and provide overall benefit the species.

Impacts to Hawaiian hoary bat roosting would be the same as under the No Action alternative (no impacts). Impacts from decommissioning activities would also be the same as under the No Action alternative.

Impacts of Monitoring and Mitigation Measures

As part of the Proposed Action, year-round fatality and compliance monitoring would be implemented. This monitoring would document and report all Covered and Non-Covered Species fatalities and injuries and allow for an assessment of Project effects to the Hawaiian hoary bat.

As discussed in section 2.2.1.3, to offset potential bat take that could result from Project operations, the Applicant would fund a habitat restoration to facilitate lowland mesic-wet ohia forest recovery would restoration efforts for lowland forest habitat. The rationale supporting a land component is provided previously in Section 2.2.1.3. In brief, the dollar amount of the mitigation is based on the cost of restoring 90 acres of degraded bat and wildlife habitat in the Kahuku Unit of HVNP. However, the success criteria of the mitigation is not based on the amount of funding provided. The Interagency Bat Guidance identifies research priorities that will provide information relevant to effective Hawaiian hoary bat mitigation. By adopting the "best scientific data available" standard in the ESA, Congress indicated it expected that the USFWS will make decisions on the basis of "available" information. The reinitiation of consultation provisions of section 7 of the ESA, and the adaptive management provisions of the Lalamilo

HCP, provide a mechanism for the USFWS and the applicant to adjust the HCP's conservation strategy to reflect new scientific information. Although the Interagency Bat Guidance envisions the ability to leverage research results to improve mitigation approaches for this species in the next 3 – 5 years, the guidance provides flexibility for research needs that extend beyond the five year timeframe.

There are currently no effective tools or techniques available to directly measure the increase in a population of solitary, tree-roosting bats with any degree of certainty. Therefore, measures of habitat quality were identified to act as appropriate surrogate measures to track and demonstrate improvements to habitat expected to benefit the Hawaiian hoary bat. The success criteria of the mitigation are based on the actual outputs of the mitigation projects which use surrogate measurements based on the best science and the associated uncertainty. Section 2.2.1.3.2 summarizes the objective measures of success for restoration activities based on surrogate habitat measures, deemed by both the USFWS and DOFAW (and documented in the Interagency Bat Guidance) to appropriately gauge progress toward habitat improvements that would benefit the Hawaiian hoary bat. In addition, research results from other agency-approved research projects can be leveraged for planning future management actions or adaptively managing the Lalamilo mitigation actions. And finally, the inclusion of an adaptive management program in the HCP and the required monitoring of mitigation and take allow for an on-going assessment of the amount of take relative to the amount of mitigation. Completion of the success criteria proposed in the HCP would be expected to offset the requested take of the Hawaiian hoary bat based on the best science and the uncertainty recognized and acknowledged by the Service.

The minimization and mitigation measures included in the Project HCP were developed to address an estimated level of incidental take and are required to be implemented even if the actual level of incidental take is less than estimated in the HCP. Key components of the Project HCP include monitoring to document fatalities or impacts to the covered species and the effectiveness of mitigation actions, and adaptive management. This combination of measures allows the Applicant and the USFWS to track compliance and react to conditions that suggest take or mitigation would not be consistent with expectations based on assumptions in the HCP. The use of adaptive management to continually evaluate the effectiveness of the HCP avoidance and minimization measures represents the best scientific data available for minimizing impacts to listed species over the life of the permit.

The Applicant would provide funding for 90 acres of site restoration that would consist of native plant establishment and seed dispersal, invasive species control, long-term maintenance, and invasive species monitoring. These activities would protect native vegetation from disturbance and destruction, facilitate the growth of native plants by eliminating invasive species that compete against or prevent native plant regeneration, and work to reestablish a self-sustaining native forest. For these reasons, proposed forest habitat restoration would be expected to protect and improve bat foraging and roosting habitat, which would lead to long-term species benefits through increased adult and juvenile survival as well as increased productivity. But for these actions, the habitat would not be of high value to the Hawaiian hoary bat.

Forest restoration activities could result in short-term disturbances from worker and vehicle noise, as well as surface disturbance associated with seedling planting. However, all mitigation measures would be subject to review by the DOFAW and the Service over the lifetime of the Project to ensure the success of proposed mitigation.

The Service acknowledges the uncertainties associated with the bat biology. The wildlife agencies have worked with the Applicant to develop measureable surrogates for assessing benefits to the bats. These are presented in the form of the success criteria and specific objectives described in this document and in the HCP. If the success criteria are not met or adaptive management indicates a change in success criteria is

necessary, the Applicant would be responsible for meeting the mitigation obligation. For these reasons, no adverse impacts to the Hawaiian hoary bat population would be anticipated from the Proposed Action.

3.4.1.1.3. Alternative 3 (No Curtailment Alternative)

Evidence from the U.S. mainland shows collision risks to bats are greatest during lower wind speeds (Arnett et al. 2008), though specific data on the flight behavior for Hawaiian hoary bat is lacking. Under the no curtailment alternative, there would be up to five turbines operational during periods of low wind, potentially increasing incidental take by 40% or greater. This Alternative would result in an increase in the time during which the turbine blades would be rotational, particularly at lower wind speeds, and would present a greater risk of collision-related mortality. Therefore, under this alternative, fatalities over the next 20 years would be estimated at 10 bats, and the take authorization requested through the HCP would need to be adjusted accordingly. This projection is based on the addition of all five turbines being operational. Actual take could be higher or lower then 10 bats, but the no curtailment alternative would likely have greater take then the proposed alternative.

Impacts from localized noise, lighting, and human or vehicle activity associated with current operation and maintenance tasks, impacts to roosting habitat, and impacts from decommissioning the project would be the same as under the No Action alternative or Proposed Action Alternative.

Impacts of Avoidance and Minimization Measures

Under Alternative 3 voluntary on-site minimization and avoidance measures would be implemented to help reduce the risk of bat take (see Section 2.1.1).

As discussed in section 2.2.1.3, to offset potential bat take that could result from Project operations, the Applicant would fund a habitat restoration to facilitate lowland mesic-wet ohia forest recovery restoration efforts for lowland forest habitat. However, compensatory mitigation measures as described for the proposed action would need to be increased commensurate with the increase in take expected when all five turbines are operating simultaneously during low wind speed.

3.4.1.1.4. Alternative 4 (Increased Cut-in Speed Alternative)

The impacts of this alternative on the human environment are likely to be similar to the proposed action alternative. Given the level of uncertainty and lack of scientific evidence, an incremental increase of cut-in speed under the proposed HCP may or may not reduce take of Hawaiian hoary bats compared to the proposed action

The Service evaluated available data on operational avoidance and minimization measures to determine if this was a viable alternative for reducing incidental take of the Hawaiian hoary bat, which is a solitary tree roosting bat that has distinctly different movement behaviors than the migratory bat species on the U.S. mainland. There is strong scientific evidence that bat fatalities, especially fatalities of migratory bats, are reduced on the U.S. mainland when turbines are curtailed and/or blades feathered compared to bat fatalities at turbines that are not curtailed or feathered. These beneficial effects of low wind speed curtailment on reducing bat fatalities has been demonstrated in a number of studies conducted on the U.S. mainland and Canada (Arnett et al. 2011; Arnett et al. 2013b; Baerwald et al. 2009; Hein et al. 2014) as follows: .

- Baerwald et al. (2009) conducted a study during the peak period of migration (August 1–September 7, 2007) for hoary bats (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*) at a wind energy installation in southwestern Alberta, Canada, where the two bat species comprised the dominant fatalities. They tested three treatment groups (control turbines,

treatment turbines with increased cut-in speed, and experimental idling turbines with the blades manipulated to be motionless during low wind speeds). When the group combined the two experimental treatment results and comparing them to control turbines, they concluded that the experimental turbines had lower fatality rates for each species.

- Young et al. (2011) found that feathering the blades to reduce the rotational speed of turbine blades at or under the manufacturer's cut-in speed of 4.0 m/s significantly reduced bat fatalities.
- Young (2013) saw a 62% reduction in bat fatalities when feathering was implemented at 5.0 m/s and below, though the study was a comparison made across two years, 2011 (no feathering) and 2012 (with feathering), and assumes that other factors that may influence bat fatality were the same in years 2011 and 2012. Good et al. (2012) found that turbines that feathered at 3.5 m/s, 4.5 m/s, or 5.5 m/s had significantly fewer fatalities than turbines that were not feathered. In addition, fatalities decreased with each feathering increment up to 5.5 m/s.
- Arnett et al. (2009, 2010, and 2011) showed an average reduction in bat fatalities of 72-82%, depending on year, with the implementation of curtailment and blade feathering when compared to no curtailment. Arnett et al. reported a 54.4% (95% CI: 17.7–74.7) and 76.1% (95% CI: 49.1–88.8) reduction in bat fatalities for the 5.0 m/s and 6.5 m/s treatments, respectively. However, the fatality rate for the 6.5 m/s treatment was not significantly lower than the fatality rate for the 5.0 m/s treatment ($P = 0.103$).
- Hein et al. (2014) found a significant reduction in bat fatality rates when turbines were curtailed and blades fully feathered at 5.0 m/s and at 6.5 m/s when compared to turbines that were not curtailed. However, the bat fatality rate for the 6.5 m/s treatment was not was not significantly lower than the fatality rate for the 5.0m/s treatment (P – 0.103).
- Arnett et al. (2013) synthesized the results of 10 wind energy projects in North America and identified only one study in Sheffield, Vermont that found increasing cut-in speeds to 6.0 m/s resulted in a 60% reduction in bat fatality relative to that observed at turbines with a cut-in speed of 4.0 m/s. A study conducted at Beech Ridge, West Virginia, found a bat fatality reduction of approximately 89% when all turbines were curtailed at 6.9 m/s for the study, but the reduction was based on a comparison with other facilities, Mount Storm and Mountaineer, that were not curtailing and the study was not a comparison with other turbines at the Beech Ridge site, nor were other cut-in speeds evaluated (Tidhar et al. 2013). Arnett et al. (2013b) also reported the results from a wind farm in USFWS Region 8. Compared to the bat fatalities at turbines set to a cut-in speed of 3.0 m/s, the following reductions in bat fatality were obtained in each treatment: 20.1% at 4.0 m/s, 34.5% at 5.0 m/s, and 38.1% at 6.0 m/s during the first four hours after dark, and 32.6% for turbines raised to 5.0 m/s all night long. None of the reductions in fatality were considered statistically significant (chi-square test $p>0.05$) between turbines with cut-in speeds raised to 5.0 or 6.0 m/s, regardless of whether the treatment occurred only during the first four hours after dark (5.0 and 6.0 m/s) or was left in place all night (5.0 m/s).
- Good and Adachi (2014) reported that the effectiveness of curtailment speeds can depend on the deceleration and acceleration profile of the specific turbine model.
- Cryan et al. (2014) analyzed wind turbine activities at a facility in northwestern Indiana using thermal video-surveillance cameras, supplemented with near-infrared video, acoustic detectors, and radar. They found that wind speed and blade rotation speed influence the way that bats approached turbines. Bats approached turbines less frequently when their blades were spinning fast, and the prevalence of leeward versus windward approaches to the nacelle increased with wind speed at turbines with slow-moving or stationary blades

A statistically significant reduction in bat fatalities that can be attributed to cut-in speeds above 5.5m/s is presently limited to a study with migratory bat species found on the U.S. mainland. The effect of higher cut in speeds such as 6.5 m/s have not been evaluated in Hawaii because of the 1) large uncertainty associated with estimating fatalities for a rare event, 2) lack of surrogate species that can be used in Hawaii for estimating take of the bat and demonstrating real treatment differences, 3) lack of statistical power because of small project size and high site variability, 4) unknowns surrounding Hawaiian hoary bat flight behavior, 5) existing power purchase agreements already in place and 6) the impacts of an increased cut-in speed on reduction in renewable power production. As cut-in speed increases, the amount of time and the speed at which the turbine blades are spinning decreases.

A reduced number of bat fatalities could occur simply because of the reduction in operational time of the turbines and be unrelated to wind speed. Arnett et al.'s (2013) synthesis suggests that steps, such as feathering blades, can be taken to significantly reduce tip speeds and hazards to bats. Increasing turbine cut-in speeds with full feathering effectively reduces the time that a turbine spends rotating in low wind speeds and effectively reduces the risk to bats, but the reduction in fatalities gained with cut-in speeds above 5.0 m/s or 5.5 m/s is highly variable in the published studies, largely anecdotal, and will be highly speculative in Hawaii. Additionally, unlike the seasonal-related vulnerability associated with migratory bats on the U.S. mainland, Hawaiian hoary bats may transgress through Hawaii-based wind farms year-round, thus curtailment must be deployed year-round at the permitted wind facilities in Hawaii. This creates a larger loss of renewable energy per turbine than wind farms operating on the U.S. mainland when considering the typical 20-year term of an ITP. An increased cut-in speed would also require increased use of a dusk to dawn available energy type, such as fossil fuel, to operate the water well pumps without the assurance of any reduced take benefits to the bats. Given the above uncertainty and lack of scientific evidence, an incremental increase of cut-in speed under the proposed HCP may or may not reduce take of Hawaiian hoary bats compared to the proposed action, but is likely to reduce renewable power production and increase dependence on fossil fuels to operate the water well pumps.

Impacts of Avoidance and Minimization Measures

Under Alternative 4 voluntary on-site minimization and avoidance measures would be implemented to help reduce the risk of bat take (see Section 2.1.1).

As discussed in section 2.2.1.3, to offset potential bat take that could result from Project operations, the Applicant would fund a habitat restoration to facilitate lowland mesic-wet ohia forest recovery restoration efforts for lowland forest habitat. However, given that an incremental increase of cut-in speed under the proposed HCP may or may not reduce take of Hawaiian hoary bats compared to the proposed action, it is unknown if compensatory mitigation measures as described for the proposed action would need to be increased. Given this uncertainty, this alternative has diminishing returns because of the reduction of renewable energy produced and the lack of evidence to support reduced take.

3.4.1.2. HAWAIIAN PETREL

3.4.1.2.1. Alternative 1 (No Action Alternative)

Under the No Action alternative all facility turbines would be nonoperational from dusk to dawn—i.e., completely curtailed at night. Increased curtailment could provide some indirect conservation benefits to individual petrels that fly over the Project area by reducing mortality during curtailment periods.

The three nearest breeding colonies are located approximately 39 miles away from the Project and would not be directly affected by the Proposed Action. However, the Project could attract, disorient, or displace petrels flying to or from the colonies due to localized noise, lights, and human or vehicle activity

associated with current operation and maintenance tasks. Most of this activity would be intermittent and short term, with the exception of turbine operation. Past avian surveys suggest that the Project area experiences low levels of inland bird movement (approximately two birds per hour). Therefore, only a limited number of petrels would likely pass over the Project area. Additionally, evidence suggests that petrels are highly capable of avoiding vertical structures under low-light conditions (Cooper and Day 1998; KWP 2009, 2010; Tetra Tech 2008). Therefore, this EA assumes that the majority of birds would be able to detect and re-route around operating turbines.

Continued grazing to maintain appropriate vegetation conditions for post-construction mortality surveys would not affect petrels, because breeding sites are located 39 miles away from the Project area and forage occurs at sea. Decommissioning effects would be similar to those described for the Hawaiian hoary bat.

Impacts of Avoidance and Minimization Measures

The No Action Alternative would maintain current voluntary on-site minimization and avoidance measures, such as using shielded light fixtures and minimizing nighttime activities to avoid the use of lighting that could attract Hawaiian petrels, to further reduce project risks to birds in transit over the Project area (Section 2.1.1).

Based on these measures, combined with the reduced chance of mortality, no significant adverse population-level effects are anticipated for the Hawaiian petrel under the No Action Alternative. Without an approved HCP and subsequent ITP, however, the off-site mitigation measures described therein would not occur and no benefits to the species would occur. .

3.4.1.2.2. Alternative 2 (Proposed Action)

Under the Proposed Action, potential direct impacts could occur to Hawaiian petrels due to mortality or injury associated with collision with turbines or other Project structures when birds are flying to and from breeding colonies. No documented petrel fatalities have occurred at the Project to date. However, based on modeled exposure and fatality rates, it is estimated that up to three petrel fatalities could occur over the next 20 years under current Project operations (SWCA 2017). The proposed take estimate is based on the collision fatality risk of three turbines operating simultaneously and without implementation of the avoidance and minimization measures or low-wind speed curtailment. Therefore, with the addition of low-wind speed curtailment in the Proposed Action (discussed under Section 2.2.1.1) actual take may be reduced below three petrels. The effects of low wind speed curtailment in not known for petrels.

The Hawaiian petrel population was most recently estimated to consist of approximately 2,000 individuals on the Island of Hawaii (Cooper and Day 2004). Predicted total take for the Proposed Action represents 0.15% of the population on the island. Therefore, fatalities resulting from operation of the Project are unlikely to have population-level impacts to the local petrel colonies.

Impacts from localized noise, lighting, and human or vehicle activity associated with current operation and maintenance tasks, impacts from continued grazing, and impacts from decommissioning the project would be the same as under the No Action alternative.

Impacts of Monitoring and Mitigation Measures

Fatality and compliance monitoring would be implemented as described for the Hawaiian hoary bat and would allow for an assessment of Project effects to local petrel populations. Effectiveness monitoring would be conducted by HVNP using standard NPS monitoring procedures to determine if the success

criteria, as indicated by increased survival are being met. The outcomes would be reviewed by the wildlife agencies in the semiannual and annual reports provided by the Applicant.

To offset potential take that could result from Project operations, the Applicant would contract with HVNP and provide the funding necessary to remove predators (cats and mongoose) within a recently constructed exclosure (about 640 acres) surrounding a remote Hawaiian petrel nesting colony to below detection level during years 1 and 2 of the mitigation project. The additional cycle of monitoring and predator removal in year 7 of the mitigation project would provide additional assurance that the exclosure is predator free, or near to it. Ongoing nest density monitoring would evaluate the success of proposed mitigation over time (see Section 9.3 of the HCP for details). If mitigation credit falls short of what is required to fulfill statutory requirements, additional mitigation would be implemented at the site as part of adaptive management. Should the monitoring indicate the success criteria are not being met by the Applicants mitigation, the Service would work with the Applicant and HVNP to identify an approach or modification based on best science available that would meet the mitigation goals and offset take to the maximum extent practicable. This mitigation project is expected to fully offset and exceed the impact of the taking because it is expected that more individuals would be relieved from the pressures of predation than those taken as a result of operation of the Lalamilo Project.

Predator-control activities would result in long-term, intermittent human disturbance associated with trapping, fence maintenance, and monitoring activities. However, mitigation would also result in an overall net conservation benefit for the petrels and other seabird species, such as band-rumped storm petrel, that utilize the mitigation site, through removal of predators and protection of burrows. The reduction and removal of the predator threats would lead to increased adult and juvenile survival. For these reasons, no adverse impacts to Hawaiian petrel populations will be anticipated for the Proposed Action.

3.4.1.2.3. Alternative 3 (No Curtailment Alternative)

The effect of no curtailment on petrels is not known. In general, curtailment is not thought of as having large reduction impacts on mid to large size birds, as they can fly in all types of wind. Because the risk to the petrel is so low, it is unlikely that a 3.5 m/s cut in speed and the increase of up to five turbines operating simultaneously during periods of low wind speed would change the amount of take requested under the Proposed Action. Impacts from localized noise, lighting, and human or vehicle activity associated with current operation and maintenance tasks, impacts to roosting habitat, and impacts from decommissioning the project would be the same as under the No Action and Proposed Action alternatives.

Impacts of Avoidance and Minimization Measures

Alternative 3 would maintain current voluntary on-site minimization and avoidance measures, such as using shielded light fixtures and minimizing nighttime activities to avoid the use of lighting that could attract Hawaiian petrels, to further reduce project risks to birds in transit over the Project area (Section 2.1.1).

Without an approved HCP and subsequent ITP, however, the off-site mitigation measures described therein would not occur and no benefits to the species would occur. .

3.4.1.2.4. Alternative 4 (Increased Cut-in Speed Alternative)

The effect of increased cut-in speeds on petrels is not known. Because the risk to the petrel is so low under the Proposed Action and the fact that petrels fly in all types of wind, it is unlikely that a 6.5 m/s cut in speed would change the amount of take. Impacts from localized noise, lighting, and human or vehicle

activity associated with current operation and maintenance tasks, impacts to roosting habitat, and impacts from decommissioning the project would be the same as under the No Action and Proposed Action alternatives.

Impacts of Avoidance and Minimization Measures

The impacts of the avoidance and minimization measures would be the same as under the Proposed Action.

3.4.2. Non-Covered Species

3.4.2.1. MIGRATORY AND NON-MIGRATORY BIRDS

3.4.2.1.1. Alternative 1 (No Action Alternative)

Even with curtailment from dusk to dawn, it is possible for individuals of any of the bird species identified as present or potentially present in the Project area (Section 3.3.2.1) to collide with Project components, although that potential is expected to be greater for birds that regularly fly well above ground than for those that usually remain low or concealed in vegetation and for birds that are active during daylight hours. Similarly, Project vehicles or equipment also have the potential to strike downed birds (birds already injured by collision with turbines or towers) or foraging owls.

The potential for take would vary by species. No pueos have been observed in the Project area (Tetra Tech 2014). Other avian species that are known to fly over the Project area or use ranchlands and grassland habitats, such as the house finch, sky lark, and Pacific golden-plover, would be at higher risk. However, implementation of avoidance and minimization measures, described further below, would decrease the potential for mortality or injury from collisions during the crepuscular and nighttime periods.

Ongoing vegetation maintenance (through grazing) would occur in an area that has previously been disturbed, and would not substantially alter existing foraging or nesting habitat conditions. No other habitat alteration or removal would occur under the ITP.

Noise and human disturbance would occur intermittently during operations in association with routine operation and maintenance activities or during decommissioning; however, due to the temporary and localized nature of these impacts, no long-term disturbance of MBTA-protected or other avian species' breeding or foraging activities within the Project area would be anticipated. In the long term, Project decommissioning would maintain or potentially improve habitat through the restoration of pre-existing vegetative communities.

Impacts of Avoidance and Minimization Measures

Adherence to voluntary avoidance and minimization measures for Covered Species, including vehicle speed restrictions on Project roads and curtailed nighttime activities and restricted use of nighttime lighting, would also benefit MBTA-protected or other bird species that use on-site habitat or potentially fly over the Project area. These measures would decrease the risk of mortality or injury from collisions and would reduce the likelihood of attracting or disorienting migrating birds.

Without an approved HCP and subsequent ITP off-site mitigation measures described therein would not occur which could also benefit migratory and non-migratory birds. Based on the avoidance and minimization measures described in Section 2.1.1, Project impacts are not expected to be significant at the population level.

3.4.2.1.2. Alternative 2 (Proposed Action)

Under the Proposed Action, direct and indirect effects associated with general Project operation, decommissioning, and implemented avoidance and minimization measures would be as described for the No Action Alternative without the potential benefits provided by complete nighttime curtailment. Low wind speed curtailment and feathering of blades at night could also provide some indirect conservation benefits to MBTA-protected or other bird species that fly over the Project area at night, but the turbines may be in operation when wind speeds are greater than 5.5 m/s and would pose a risk of collision.

Impacts of Monitoring and Mitigation Measures

As part of the Proposed Action, the Applicant would conduct fatality and compliance monitoring, which would document and report all fatalities and allow for assessment of Project effects to both Covered Species and Non-Covered Species, including MBTA-protected or other bird species.

To offset Covered Species take, the Applicant would provide additional funding and support to implement petrel predator-control measures, restore bat habitat, and/or support bat research. Although some of these actions could result in short-term ground disturbance and vegetation removal, worker and vehicle construction noise, and human disturbance, the mitigation measures would also provide some tangential conservation benefits to MBTA-protected or other avian species that use the habitats being improved by the mitigation actions. The predator control inside the 640 acre fenced area of HVNP would benefit other listed and non-listed seabirds and ground nesting birds that utilize the site for nesting. This would include the band-rumped storm petrel, Newell's shearwater, and other MBTA and non-MBTA seabird species. The invasive plant species removal in the Kahuku Unit of HVNP would benefit other listed and non-listed wildlife and flora. Removal of invasive flora would reduce non-native competition for resources and allow native seed banks and supplemented native seeds to germinate. Native outplantings would provide a missing component of the under and overstory structure. Trust resources such as water and soil would potentially benefit from the removal of the invasive flora such as strawberry guava that negatively impact water availability for native species.

3.4.2.2. ALTERNATIVE 3 (NO CURTAILMENT ALTERNATIVE)

Under Alternative 3, direct and indirect effects associated with general Project operation, decommissioning, and implemented avoidance, minimization, and mitigation measures would generally be as described for the Proposed Action alternative. However, under this alternative, there would be no curtailment—i.e., all facility turbines would be operational at all times. The reduced curtailment would increase the risk for mortality for species that are active from dusk to dawn over the no-action and proposed action alternatives.

Impacts of Monitoring and Mitigation Measures

Mitigation, commensurate with increased take levels, would benefit species as described above for the Proposed Action Alternative.

3.4.2.3. ALTERNATIVE 4 (INCREASED CUT-IN SPEED ALTERNATIVE)

Under Alternative 4, direct and indirect effects associated with general Project operation, decommissioning, and implemented avoidance, minimization, and mitigation measures would generally be as described for the Proposed Action alternative. However, under this alternative, there may be increased cut-in speed that may reduce the risk for mortality to species but the amount is not known.

Impacts of Monitoring and Mitigation Measures

Because it is not known if increased cut-in speeds would reduce the potential for mortality, it is unknown if there would be a change to the mitigation measures disclosed under the Proposed Action. However, it is assumed the mitigation would benefit species as described for the Proposed Action.

3.4.2.4. OTHER SPECIES

3.4.2.4.1. Alternative 1 (No Action Alternative)

Under the No Action Alternative, nighttime curtailment could decrease the availability of avian and bat carcasses as an additional food source available to scavenging species during curtailment periods. Given the low numbers of bird and bat take estimated for the Project, however, these carcasses would be unlikely to result in a significant change in food supply that affects the population status for any of these non-native species.

During operation, loss of other non-native species (e.g., rats, mongoose, dogs, and feral cats or goats) could occur occasionally as a result of collisions with project vehicles. A reduction in introduced species could be considered a positive effect of the No Action Alternative; although, given the scale of the project, any actual change in local mammal numbers would likely to be so low they would not create a noticeable change.

Operation of the project could also directly attract other scavenging wildlife to avian and bat carcasses as an additional food source available to these scavenging species. Given the low numbers of potential take of bird and bats, these carcasses would unlikely result in a change to the food supply that affects the population status for any of these non-native species.

Impacts of Avoidance and Minimization Measures

Voluntary avoidance and minimization measures implemented to reduce the risk of collisions between Covered Species and Project vehicles would likewise reduce the collision risk for other non-native species.

3.4.2.4.2. Alternative 2 (Proposed Action Alternative)

Under the Proposed Action, direct and indirect effects associated with general Project operation and implemented avoidance and minimization measures would be as described for the No Action Alternative.

Impacts of Monitoring and Mitigation Measures

Proposed petrel mitigation measures would decrease the number of introduced predators present within the mitigation site. Overall, this measure would contribute to a reduction in some introduced species locally, while potentially improving native species' survival. Removal of invasive, non-native flora at the mitigation site would cause localized reductions of some introduced species and their seeds.

3.4.2.4.3. Alternative 3 (No Curtailment Alternative)

Under Alternative 3, direct and indirect effects associated with general Project operation and implemented avoidance, minimization, and mitigation measures would generally be as described in the Proposed Action Alternative. However, under this alternative all facility turbines could be operational at all times.

No curtailment could increase the availability of avian and bat carcasses as an additional food source available to scavenging species during curtailment periods. Given the low numbers of bird and bat take estimated for the Project, however, these carcasses would be unlikely to result in a change in food supply that affects the population status for any of these non-native species.

Impacts of Monitoring and Mitigation Measures

Voluntary avoidance and minimization measures implemented to reduce the risk of collisions between Covered Species and Project vehicles would likewise reduce the collision risk for other non-native species.

3.4.2.4.4. Alternative 4 (Increased Cut-in Speed Alternative)

Under Alternative 4, direct and indirect effects associated with general Project operation and implemented avoidance, minimization, and mitigation measures would generally be as described in the Proposed Action Alternative. However, under this alternative all facility turbines could be operational at all times.

Reduced curtailment could decrease the availability of avian and bat carcasses as an additional food source available to scavenging species during curtailment periods but that is uncertain. Given the low numbers of bird and bat take estimated for the Project, however, these carcasses would be unlikely to result in a change in food supply that affects the population status for any of these non-native species.

Impacts of Monitoring and Mitigation Measures

Voluntary avoidance and minimization measures implemented to reduce the risk of collisions between Covered Species and Project vehicles would likewise reduce the collision risk for other non-native species.

3.5. Cumulative Impacts

3.5.1. Introduction

A cumulative impacts assessment considers projects in the past, present, and reasonably foreseeable future, authorized or under review, which are considered to contribute to aggregate resource impacts. As stated in 40 CFR 1508.7, "Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Past and present actions are addressed through the description of existing resource conditions for affected resources in Section 3.3. Therefore, this discussion is limited to reasonably foreseeable future actions that may affect resources that were identified as issues of concern in this EA.

The Project is located on the lower (western) flank of the Mauna Kea volcano, between Waimea and Waikoloa Village, Hawaii, on state land zoned as "agriculture" and leased from the DLNR. The Department of Hawaiian Home Land's (DHHL's) Hawaii Island Plan identified a total of nine tracts of available land predominately for potential residential, pastoral, and/or agricultural development in the North Region. However, none of these tracts overlap the proposed Project (DHHL 2002). The County of Hawaii General Plan notes that population in the North Kohala region has grown significantly but that agriculture remains the key industry. No specific projects were identified for development (County of Hawaii 2005).

The Proposed Action authorizes take for a total of up to six Hawaiian hoary bats and three Hawaiian petrels over 20 years. For the purposes of this analysis, the temporal extent used to identify projects to be

considered in the cumulative effects analysis is the operational life of the Project (approximately 20 years). The spatial extent of the cumulative effects analysis is statewide across the bat's range as described in the Hawaiian hoary Bat Recovery Plan (USFWS 1998). Assuming very little movement between islands, the analysis also considered the total anticipated impact per island. No other reasonably foreseeable projects were identified for analysis. For this reason, the cumulative impact analysis evaluates the operating and proposed wind energy facilities and Federal project addressed under Section 7 across the State of Hawaii.

3.5.2. Reasonable Foreseeable Future Projects

Known existing and planned wind farms across Hawaii are listed in Table 7.

Table 7. Wind Farms in Hawaii

Name	Energy Capacity	Location	Operator
Auwahi Wind Farm	21 MW	Ulupalakua, Maui	Sempra U.S. Gas & Power
Big Island Beef Community Wind Project	100 kW	Paauilo, Hawaii	Gen-X Energy Development
Hawi Wind Farm	10.56 MW	Upolu Point, Hawaii	Hawi Renewable Development, LLC
Kaheawa Wind Power I (KWP I)	30 MW	Kaheawa, Maui	SunEdison
Kaheawa Wind Power II (KWP II)	21 MW	Kaheawa, Maui	SunEdison
Kahuku Wind Farm	30 MW	Kahuku, Oahu	SunEdison
Kawailoa Wind Power	69 MW	Kawailoa /Haleiwa, Oahu	Kawailoa Wind
Lalamilo Wind Farm Repowering Project*	3.3 MW	Lalamilo, Hawaii	Lalamilo Wind Co, LLC
Na Pua Makani Wind Project – Phase I*	24 MW	Kahuku, Oahu	Oahu Wind Partners, LLC
North Kohala Microgrid Project	0.1 MW	North Kohala, Hawaii	Gen-X Energy Development
Pakini Nui Wind Farm	20.5 MW	Ka Lae (South Point), Hawaii	Tawhiri Power, LLC
Waikoloa Water Community Wind Project	0.1 MW	Waikoloa, Hawaii	HWS Wind

* Potential wind facility

Source: Hawaii State Energy Office (2015)

3.5.3. Cumulative Effects for Each Alternative

3.5.3.1. ALTERNATIVE 1 (NO ACTION ALTERNATIVE)

Under the No Action Alternative, all facility turbines would be nonoperational from dusk to dawn—i.e., completely curtailed at night. This alternative would reduce the risk of take to bats and petrels to below a negligible level. The risk of collision to MBTA or Non-listed avian species active during the daylight hours would be minimal and equal to that of the Proposed Action and Alternative 3. Diurnally active MBTA or non-listed species transiting the site could collide with rotating turbine blades. Collision incidence would be expected to rare because only three of five turbines would be operating simultaneously. Voluntary avoidance and minimization measures established in Section 2.1.1 could be implemented to reduce maintenance and operational impacts to Covered Species, where possible. The off-

site mitigation measures described in this EA for the Covered Species would not occur. The avoidance and minimization measures could also indirectly reduce take of other non-covered avian species. For these reasons, no significant cumulative adverse impacts to Covered Species or MBTA-protected and other bird species are anticipated.

Loss of other non-native species (e.g., rats, mongoose, dogs, and feral cats or goats) could occur occasionally as a result of collisions with project vehicles. Because reduction in introduced species could be considered a positive effect and, collectively, any increase in bird or bat carcasses would be unlikely to result in a significant food supply that could affect the population status for non-native species, no significant adverse cumulative impacts to other species are anticipated.

3.5.3.2. ALTERNATIVE 2 (PROPOSED ACTION)

3.5.3.2.1. Covered Species

Cumulative effects on the Hawaiian petrels include mammalian predators, ingestion of plastics, crushing of burrows by feral ungulates such as goats, loss of suitable burrow habitat from invasive plant species, disorientation caused by unshielded lighting, and possibly climate change. Cumulative effects on Hawaiian hoary bats such as wildfire, plant diseases such as rapid ohia (*Metrosideros polymorpha*) death, and the establishment of invasive species such as strawberry guava (*Psidium cattleianum*) and miconia (*Miconia calvescens*) have resulted in the loss of bat roosting habitat and destruction of native forests. Throughout the state, real estate development and land use changes have resulted in further habitat loss for the bats. Human-associated activities expected to affect the Hawaiian hoary bats include existing barbed wire fencing, forestry practices that include the removal of trees above 15 feet in height, and wind turbines that are operational during the crepuscular and nighttime periods. Other factors that potentially impact bats or their prey include pesticides, displacement of prey resources by invasive insects, competition for prey from introduced species such as coqui frog (*Eleutherodactylus coqui*), roost disturbances, and possibly predation and climate change.

State-wide Authorized Take

In addition to these potential impacts, take for Covered Species has been authorized for projects occurring across the State through ITPs with HCPs under section 10 and through ESA section 7 consultations resulting in a Federal Biological Opinion and Incidental Take Statement (ITS) (Table 8). Under the ESA, HCPs are required to avoid, minimize and mitigate to the maximum extent practicable the remaining effects of incidental take. Projects listed in Table 8 that are conducted under a Federal Biological Opinion/ITS do not include offsetting mitigation.

The incidental take projections shown in Table 8 have been informed by fatality monitoring results from all wind facilities with ITPs in Hawaii and reflect a refinement in take estimation and accountability for observed as well as unobserved take that was not previously taken into account with earlier ITPs. In addition to the take that has already been authorized within the State of Hawaii, several wind facilities on Hawaii, Maui, and Oahu have pending ITP applications or amendments to existing permits (Table 8). On Hawaii Island, there are two other commercial-scale wind facilities besides Lalamilo in operation that are in the process of developing HCPs and seeking incidental take permits for bats. The Pakini Nui project has taken at least two Hawaiian hoary bats while operating without a permit and approved HCP over the last six years. Hawi has been in operation for over 20 years and does not have an approved monitoring plan, ITP or HCP. The amount of unauthorized take attributable to this facility is uncertain. These projects are pursuing future compliance by preparing an HCP and ITP application. On Maui, there are three commercial-scale wind farms operating with previously approved HCPs and ITPs. Due to higher

than anticipated incidental take levels of bats, two of these projects are amending their respective HCPs and ITPs. On Oahu, there are two operating wind farms, one of which is expected to amend their HCP and ITP because of bat take higher than originally projected, and a third wind farm, yet to be constructed, that is awaiting final issuance of the ITP and State ITL. The Service projected the estimated incidental take for the projects that are expected to pursue amendments (labeled with superscript "w" in Table 8) so that the take could be considered in the cumulative analysis. The projections were generated with the Evidence of Absence software Version 2 using the searcher efficiencies, carcass retention, and other parameters specific to the individual project. The Service's projections do not take into account technology or actions that could be developed and deployed in the future to reduce incidental take at any of the projects. The Service is 80% confident that the projections would not be exceeded during the remaining operational term of the specific project.

The approved HCPs listed in Table 8 include objective measures of success for reforestation or restoration activities that are based on best science to appropriately gauge progress toward habitat improvements. The mitigation actions in the approved HCPs are expected to offset the authorized incidental take of Covered Species. Accordingly, all project-related impacts associated with HCPs would be avoided, minimized, or mitigated using the best science available and adaptive management. The approved ITPs and associated HCPs include monitoring to document impacts to the Covered Species and the effectiveness of mitigation actions in addition to adaptive management. This combination of monitoring and adaptive management allows the Applicant, USFWS, and DOFAW to track compliance with the ITP, ITL and HCP, respond to conditions that indicate take or mitigation is not meeting the success criteria, and take corrective actions to ensure mitigation needs are met. The adaptive management mechanisms included in the approved HCPs would also be required in pending HCPs (Table 8).

Table 8. Current and Projected Take Authorizations for Covered Species through Other HCPs and Section 7 Consultations

Name	Permit Duration	Location	Species and Total Take Authorization for Permit Term[Z]	Species and Total Take Pending Approval (Total Includes Previous Authorized Take)[Y]
Kahuku Wind Farm[X]	06/07/2010–06/06/2030	Kahuku, Oahu	Hawaiian hoary bat (32) Hawaiian petrel (12)	N/A
Kawailoa Wind Power	12/08/2011–12/07/2031	Haleiwa, Oahu	Hawaiian hoary bat (60)	Hawaiian hoary bat (242)[W]
Na Pua Makani Wind Project - Phase I	Not yet issued	Kahuku, Oahu		Hawaiian hoary bat (51)
U.S. Army Kahuku Training Area Single Wind Turbine	Federal Biological Opinion covering 05/05/2010-05/09/2030	Kahuku, Oahu	Hawaiian hoary bat (2 adults, 2 pups)	N/A
Auwahi Wind Farm	02/24/2012–02/23/2037	Ulupalakua, Maui	Hawaiian hoary bat (21) Hawaiian petrel (87)	Hawaiian hoary bat (205)[W]
Kaheawa Wind Power I (KWP I)	04/30/2012[V]–01/29/2026	Kaheawa, Maui	Hawaiian hoary bat (50) Hawaiian petrel (38)	N/A
Kaheawa Wind Power II (KWP II)	1/3/2012–1/2/2032	Kaheawa, Maui	Hawaiian hoary bat (11) Hawaiian petrel (43)	Hawaiian hoary bat (48)
Big Island Beef Community Wind Project[U]	N/A	Paauilo, Hawaii	N/A	N/A
Hawi Wind Farm	Not yet issued	Upolu Point, Hawaii		Application not yet submitted
Lalamilo Wind Farm Repowering Project	Not yet issued	Lalamilo, Hawaii		Hawaiian hoary bat (6) Hawaiian petrels (3)
North Kohala Microgrid Project[U]	N/A	North Kohala, Hawaii	N/A	N/A
Pakini Nui Wind Farm	Not yet issued	Ka Lae (South Point), Hawaii		Hawaiian hoary bat (83) Hawaiian petrels (3)
Pelekane Bay Watershed Restoration Project	2010 Federal Biological Opinion 02/05/2010-02/04/2030	Pelekane Bay, Hawaii	Hawaiian hoary bat (16)	N/A
Waikoloa Water Community Wind Project[U]	N/A	Waikoloa, Hawaii	N/A	N/A

[Z] Other species may also have incidental take authorizations not reported here
[Y] Projected take based on using an 80% credibility level in the Evidence of Absence software and includes indirect take
[X] Federal Biological Opinion. Take numbers listed are from the State of Hawaii Incidental Take License
[W] Take projections at the 80% credibility levels made by the Service
[V] Original permit issued in 2006 and amended in 2012
[U] Informal consultation completed with a "not likely to adversely affect" determination—no incidental take (turbines inactive at night)

Hawaiian hoary bat: Cumulative effects assumptions and analysis

In light of the substantial gaps in baseline population and life history information for the Hawaiian hoary bat, the Service analyzed the cumulative effects on bats using the following assumptions:

- Hawaiian hoary bats are sparsely distributed across their habitat
- Requested take would remain relatively constant over the remaining permit term for a facility

- The number of bats that fly through the rotor sweep area would not significantly decrease over time
- A Hawaiian hoary bat would forage an average of 7 miles, one way, from their roost
- Bats transgress across a Project site by chance, not because they are attracted to the attributes of the wind turbine or site characteristics
- The population within 7 miles of the turbine would be stable for the duration of the project
- The Hawaiian hoary bat population across the State of Hawaii is analyzed based on reasonable estimates of 5000 and 2500 bats
- Hawaiian hoary bat movement between islands is rare

It is assumed that the projections shown in Table 8 would remain relatively constant over the remaining permit term for a facility, though there may be stochastic variation among years. The projections assume the number of bats that fly through the rotor sweep area would not significantly decrease over time. This is based on the observation that incidental take of bats has not declined, except for the reduction associated with the implementation of low-wind speed curtailment at 5.0-5.5 m/s. Hawaiian hoary bats are believed to be sparsely distributed across the habitats they utilize. Male Hawaiian hoary bats are thought to be territorial towards other males and have non-overlapping foraging and roosting home ranges of 10-58 acres (Bonaccorso et al. 2015). Unlike males, the home ranges of females may overlap (Bonaccorso et al. 2015). Nightly movements of 6-12 miles (10–20 km) have been reported for hoary bats in Canada (Barclay 1989) and for insectivorous bats elsewhere (Amelon et al. 2014, O'Donnell 2001). In Hawaii, measured one way movements by Hawaiian hoary bats within a night were up to 7 miles (11.3 km) (Bonaccorso et al. 2015). Assuming that a typical bat may forage an average of 7 miles (11.3 km), one way from their roost, then bats within that approximate distance from a wind facility could theoretically pass through the project area. This analysis assumes the bats are passing through the Project site by chance, and are not attracted specifically to the attributes of the wind facility or turbine. The projection for take is based on the premise that a bat taken by a wind facility would be replaced by another bat that would move into the vacated niche. Under this scenario, the population would be stable and that the Projects' operation would not result in local resource (bat) depletion. It is also expected that the mitigation provided would offset the fatalities by providing long-term foraging resources and habitat for the bats that was not previously available and that localized extinction would not occur because of continuous replacement.

Alternatively, if territoriality and sparse distribution of bats is taken into account, then it is plausible that a vacant niche created by a fatality is not immediately filled by another bat. The previous scenario in the paragraph above did not account for localized decrease in the number of bats within a 7 mile radius of a turbine due to fatalities attributable to wind energy facilities. If a localized depletion of bats were to occur, then the estimated total take would also decrease over time. Thus, if take and acoustical detections were to unexplainably decrease, while all other non-Project related sources of mortality remained constant, then it would be reasonable to assume the wind facility was contributing to an adverse effect on the localized population.

However, to date, the decreases in take that have been observed have correlated with the implementation of curtailment and feathering of turbines during low wind speeds at nights. Acoustic detection remains similar among years without and with curtailment, suggesting the decrease in take is attributable to the curtailment and feathering and not the depletion of local bat population around the wind facilities.

Lack of basic demographic information about bats in general has impeded the Service's ability to empirically determine if bat fatalities from wind energy developments present a serious threat to the viability of the species (Diffendorfer et al. 2015). The median population growth rates for migratory bats

estimated from published studies and expert opinion are λ =1.0025 and λ = 1.015, respectively (Frick et al. 2017). Projection modeling simulations using data from migratory bats on the US mainland indicate that population growth rates (λ) would need to be 1.06 to 1.14 to sustain a stable population if 3-7 % of the population was removed annually (Frick et al. 2017). The results strongly suggested that conservation planning to manage migratory bat populations should include actions to reduce bat fatalities at wind energy facilities.

In the State of Hawaii, if the pending take for all projects in Table 8 were to be authorized, the projected Hawaiian Hoary bat take based on Service projection, over the next twenty years would be no more than 569 bats [Total take of 737 minus the 168 bats already estimated to be taken and for which mitigation has already been completed or is underway]. The authorized and projected take (569) is spread across projects on three islands, Oahu (259), Maui (229), and Hawaii (99) and over a variable period of time, depending on project. The annual projection of the Service for total take across all authorized and foreseeable pending projects statewide, is shown in Figure 4, and by island, in Figure 5. The annual projections include one bat per year that is not mitigated for and is attributed to the combined take authorization in the Pelekane Bay and U.S. Army Federal Biological Opinions. All other projected take is expected to be mitigated as described further below.

Presently there is no established population estimate for the Hawaiian hoary bat on any of the Hawaiian Islands or across the state. The Service developed two examples to illustrate what the cumulative effects may be on a conservative population estimate of 5,000 and a very conservative estimate of 2,500 bats, statewide. In developing reasonable estimates, the Service considered the best science available on the Hawaiian hoary bat distribution, the incidental take at all wind fatalities, the modeled fatality rates over all years of operation for each wind farm taking into account searcher efficiencies and carcass retention, the recent reports of bats throughout the Hawaiian islands, the nightly foraging distance of the bats, and the number and size of the area occupied by wind turbines. In the first example, we assume the population across the state is 5,000 bats. An annual statewide take of 35 bats (Figure 4) would represent approximately 0.70% of the population. Under this assumption, the population growth rate (λ) would need to be approximately 1.0141 to sustain a stable to increasing population into the next 50 years. Using the same assumption of 5000 bats, the projected annual take on the islands of Oahu, Maui and Hawaii would represent about 0.35%, 0.24%, and 0.10% respectively, of the estimated statewide population. If we assume the population is only 2,500, the projected annual take on the islands of Oahu, Maui, and Hawaii would still represent only about 0.70%, 0.48%, and 0.20% respectively. These estimates do not take into account the reduction in incidental take in future years that is associated with decommissioning of wind projects. Populations on the islands of Kauai, Molokai, and Lanai would be unaffected under the assumption that bat migration between islands is rare.

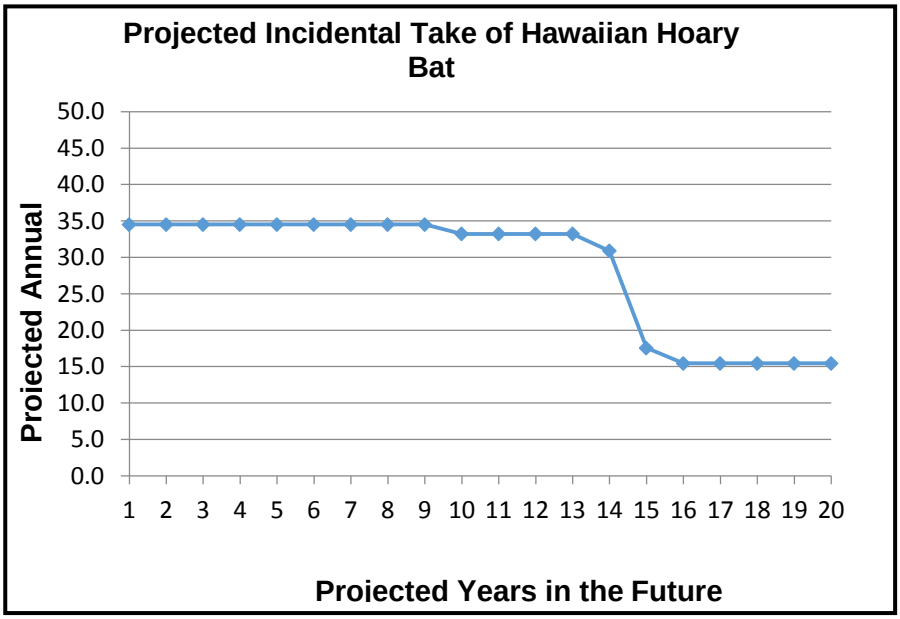
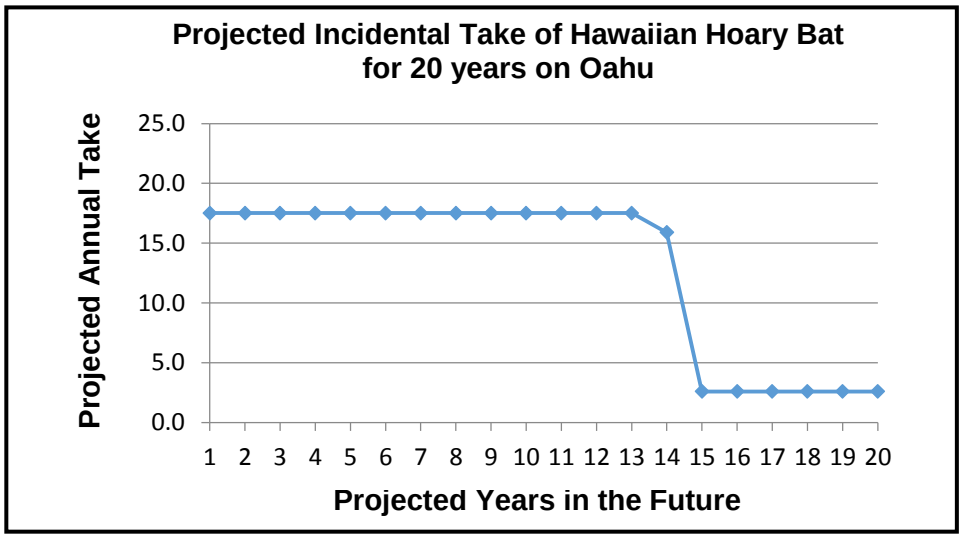
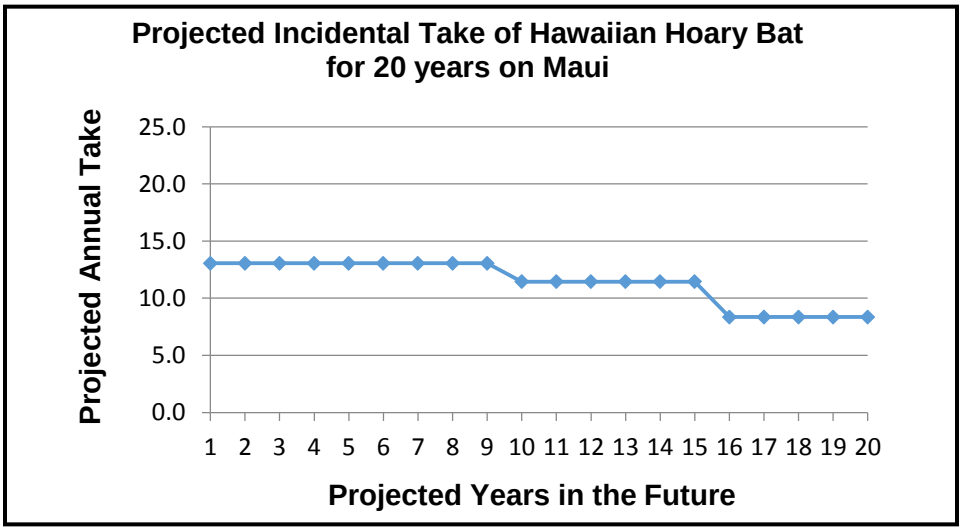


Figure 4. Projected annual incidental take of Hawaiian hoary bat over the next 20 years across the state of Hawaii. Foreseeable Projects that contribute to the projected annual take are on the islands of Oahu, Maui and Hawaii. No projects requesting incidental take of bats are expected for Kauai, Molokai, or Lanai.





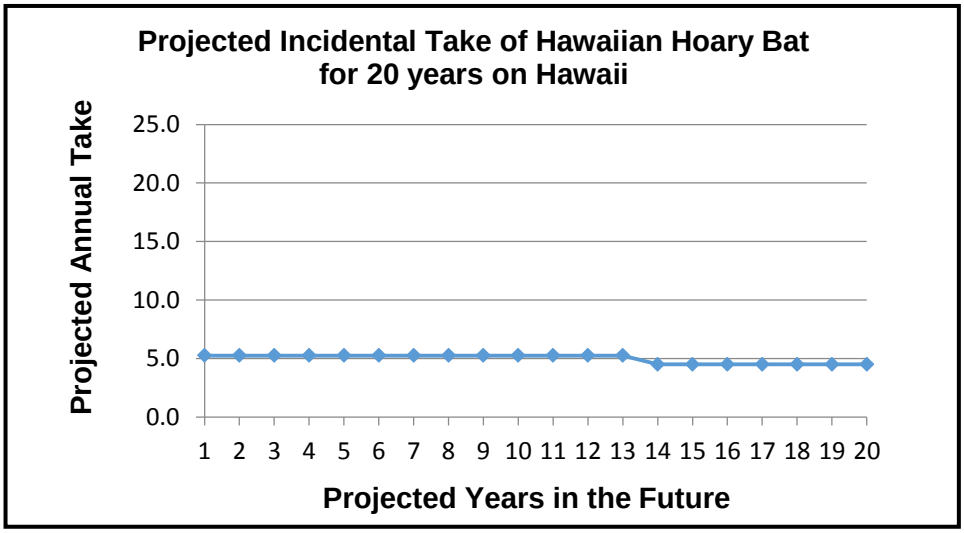


Figure 5. Projected annual incidental take of Hawaiian hoary bat over the next 20 years for the islands of Oahu, Maui and Hawaii.

Authorized take of Hawaiian hoary bats would be mitigated

The offset of take that cannot be avoided by current and pending Projects authorized under section 10 ITPs and HCPs, would be mitigated using several different approaches. These include, 1) conducting high priority research to inform and improve management for the benefit of bats (described in Section 2.2.1.3 for this Project); 2) reforestation and restoration of foraging and roosting habitats and removal of invasive species that degrade water sources, roosting, and foraging habitat of the bats (described in Section 2.2.1.3.1 for this Project); and/or 3) acquisition of suitable habitat and protection of that land for perpetuity.

This Project and the other permitted and pending projects with HCPs, have or are expected to have required mitigation plans designed to offset the projected take for the duration of the project. The Projects shown in Table 8 that have approved HCPs, or are pending, include or are expected to include, a land based component as part of the mitigation for the Covered Species. The Hawaiian Hoary Bat Recovery Plan, while dated, identifies degradation and loss of habitat as a major contributing factor to bat population decline (USFWS 1998). Mitigation actions A five year study of bat occupancy on the island of Hawaii indicates that while bats occur from sea level to the highest volcanic peaks on the island, with a fairly high occupancy throughout almost all regions, there is a significant association between occupancy and the prevalence of mature forest cover (Gorresen et al. 2013). In several of the approved Projects, land-associated mitigation has been based on the limited knowledge about bats home range size (Bonaccorso et al. 2015). Somewhat akin to resource equivalency analysis modeling used for the endangered Indiana bat, the acreage estimated as a home range of bats was multiplied by the number of bats that were expected to be taken by the Project. The total was used as the approximate amount of habitat acreage needed to offset the amount of take. In addition to acreage criteria, sites were selected because the management actions that were part of the mitigation would create or restore a suitable habitat for bats that would extend into the future. Actions have included outplanting of native tree species and invasive plant removal.

While bats have been reported to use invasive species as roosting sites, invasive species can negatively affect hydrology, soil erosion, native species diversity, changes in prey composition, and canopy characteristics which impact a wide range of native species in addition to bats. Tools to measure the direct impacts of land-based mitigation actions on bat productivity or survival are largely based on acoustical detections and knowledge gained from radio tracking, and more recently, insect composition. Surrogate measurements of success include improved canopy density, outplanting success, and amount of area cleared of invasive species.

Concurrent with the several land-based mitigation projects for bats, USGS researchers have increased the understanding of aspects Hawaiian hoary bat distribution, habitat use, prey consumption, and occupancy (Bonaccorso et al. 2015, Bonaccorso et al. 2016, Gorresen et al. 2013, Gorresen et al. 2015, Pinzari et al. 2014, Todd 2012, Todd et al. 2016). These and other research findings are used to inform the land-based mitigation actions to further benefit the bats and aid in identifying appropriate mitigation sites to support foraging, pupping, and roosting needs. Surveys have been conducted in Kahikiui Forest Reserve and Nakula Natural Area Reserve on Maui (KFR-NNAR; Todd et al. 2016). The baseline information from those surveys indicated detection probabilities, mean pulses/night, percentage of nights with feeding activity, and acoustic detections are greater in recovering forest areas than in unrestored shrublands (Todd et al. 2016). While not direct evidence that more bats are being produced in restoration areas, the results show that more detections are occurring in the restoration areas, than had previously occurred prior to restoration. It is these type of research outcomes that will guide the Service and wildlife agencies in identifying mitigation projects that continue to improve bat productivity and survival into the future.

The Hawaiian Hoary Bat Recovery Plan, Hawaiian Hoary Bat Five Year Status Review, and the Endangered Species Recovery Committee Hawaiian Hoary Bat Guidance Document, identify research on Hawaiian hoary bat biology, population, and limiting factors as priorities for the species (USFWS 1998, 2011, Amlin and Siddiqi 2015). The need for bat research was identified decades ago, but has largely gone unsupported due to limited funding and higher priorities. The past and on-going research projects that have been approved by the Service and DOFAW are expected to inform present and future land-based mitigation actions including the mitigation project proposed by Lalamilo, and are expected to largely benefit bat recovery. Practical tools for obtaining occupancy and distributional information for this species have only recently become available (Gorresen et al. 2013). An important advancement in studying a species distribution is the use of probabilistically identified sites and statistical methodology that take into account the imperfect detections of species. Occupancy models are well-suited to cryptic wide-ranging animals such as foliage-roosting bats for which counts of individuals are not available (Gorreson et al. 2008, Rodhouse et al. 2012). While such models do not allow for population estimates, they can provide an estimate of the proportion of area of interest where the species is present and can therefore serve as an alternative approach to obtaining measures of distribution, habitat associations, and trends (Gorresen et al. 2013).

Summary

Clearly, wind farms operating at night pose a threat to bats on the islands of Oahu, Maui, and Hawaii without offsetting mitigation. The absence of commercial wind facilities on Kauai Lanai, and Molokai, would suggest that those populations are not impacted. Without an established population estimate, the exact level of the impact that the projected take in pending ITP applications and amendments is uncertain. If we assume a very conservative population estimate of only 2,500 bats, the projected annual take on the islands of Oahu, Maui, and Hawaii would represent less than 1% of the population on each island. It is certain that the entire population of bats on each island would not be directly extirpated by the operation of three wind farms on the islands of Oahu, Maui and Hawaii because not every bat would transgress through the Project sites and result in a fatality. A local effect on the bat population could be expected. This local effect on population could indirectly impact the chances of the species recovering, either by reducing genetic diversity or by reducing the population below a threshold that, with the contribution of other mortality factors, would cause the population to decline below a recoverable level.

The intent of the mitigation is to offset the potential fatalities that are attributed to a project that are not avoided and minimized. Low wind speed curtailment is currently deployed by all permitted wind facilities. The mitigation contained in each of the ongoing HCPs is expected, at a minimum, to replace the bats that are incidentally taken. Mitigation actions are focused on the island on which the take is occurring to minimize any potential genetic diversity reductions. The Service expects that fully offsetting mitigation or mitigation to the maximum extent practicable would also be included in any future permits granted. The selection of scientifically sound and appropriate success criteria and the requirement that a Project must meet or exceed the success criteria in advance of the take is upon which the Service bases its analysis.

The Service recognizes there are cumulative effects from sources that are unmitigated such as bat fatalities associated with barbed wire, removal of trees that harbor non-volant bat pups during the pupping season, and wind facilities operating without an ITP and approved HCP, as described above.

Operation of the Lalamilo project at night poses a risk to bats. However, the project's implementation of low wind speed curtailment and blade feathering reduces those risks substantially for bats. In addition, the habitat restoration provided in the HCP is expected to provide compensatory mitigation to replace the low number of bats (up to 6) that may be incidentally taken as a result of this 20 year project. The combination of minimization and on-the-ground habitat restoration informed by ongoing Hawaiian hoary

bat research projects is likely to result in refined, more efficient management and improved mitigation approaches that increase the likelihood of recovery of the species in the wild and leaves no remaining take impacts that need to be addressed. For these reasons, no significant adverse impacts to the bat population on the island of Hawaii or across the State, and no significant cumulative effects to the Covered Species are anticipated from this Project.

Hawaiian petrel

As with bats, projects that have ITPs accompanied by approved HCPs authorizing take for Hawaiian petrel are fully mitigating for take and providing island-specific and potentially, state-wide benefits to the seabird population. There are unmitigated impacts on the Hawaiian Petrel from unshielded lighting and predation occurring at non-wind project sources. Operation of this Project poses a slight risk to Hawaiian petrel that may occasionally transgress over the site. The proposed mitigation for the requested take of three Hawaiian Petrel for this project has the potential to provide benefits to the entire subpopulation in the Kahuku section of HVNP, thereby more than offsetting the impacts from the requested take. For this reason, no significant adverse impact to the Hawaiian subpopulation on the island of Hawaii or population across the State are anticipated from this Project.

3.5.3.2.2. Non-Covered Species

Migratory and Non-Migratory Birds

Threats to birds in the Pacific region include habitat loss and degradation, invasive plants, non-native animals (predation, disease, and competition), human disturbance, fisheries by-catch, global climate change, and environmental contaminants (U.S. Fish and Wildlife Service 2005).

Continued operation of the project would not substantially increase these risks, but cumulative impacts could result when project actions are considered in connection with other, ongoing development across Hawaii. Although effects to MBTA-protected and other bird species are not explicitly addressed in existing HCPs and ESA Section 7 Consultations, proposed mitigation measures for other species would result in indirect conservation benefits through improved habitat and reduced predator numbers. These measures, when considered in conjunction with project avoidance, minimization, and mitigation measures, would provide a collective contribution toward regional avian conservation. For these reasons, no significant adverse impacts to avian species' overall populations and no significant cumulative impacts to MBTA-protected and other bird species are anticipated.

Other Species

Exclusion or reduction of predators through implementation of the Applicant's HCP or other approved HCPs' mitigation measures would contribute to a reduction in some introduced species locally, while potentially improving native species' survival. Because reduction in introduced species could be considered a positive effect and, collectively, any increase in bird or bat carcasses would be unlikely to result in a significant food supply that could affect the population status for non-native species, no significant adverse cumulative impacts are anticipated.

3.5.3.3. ALTERNATIVE 3 (NO CURTAILMENT)

Under this scenario, facility turbine blades would not be feathered during low wind speeds at night and could be operational at all times, which would increase the risk of additional incidental take for Covered Species and Non-Covered Species that may transgress through the Project area during night-time hours. Implementation of existing avoidance and minimization measures, with the exception of low wind speed

curtailment, and increased mitigation would be expected to fully offset the additional take of Covered Species and could have benefits for non-covered species that utilize the same habitat as the bats and petrels. The type of the mitigation (land restoration component) would be similar to that described for Alternative 2 but would be commensurate with the expected increased take. Because mitigation amount would likely be increased under this scenario, additional acreage for restoration and removal of invasive species would result in a larger benefit to the proposed mitigation area, the Kahuku Unit in HVNP, overall. Any increase in bird or bat carcasses from no curtailment would be unlikely to result in a change in food supply that could affect the population status for non-native species. For these reasons, no significant differences in cumulative impacts are anticipated.

3.5.3.4. ALTERNATIVE 4 (INCREASED CUT-IN SPEED)

Under this alternative, there would be increased cut-in speed that may reduce the risk for mortality to non-covered species but the amount is not known. The impacts of this alternative on the human environment are likely to be similar to the cumulative impacts as discussed under the proposed action alternative. Given the level of uncertainty and lack of scientific data to support a predictable reduction in fatalities, an incremental increase of cut-in speed under the proposed HCP may or may not reduce take of avian species that are active during the nighttime hours. The reduced operational time of the turbines would increase reliance on fossil fuel-generated electricity during the hours of curtailment.

4. SUMMARY OF ACTION ALTERNATIVE IMPACTS

As presented in Chapter 3, all alternatives considered for the constructed Project would result in operation and maintenance-related impacts to species. Alternative 1 (No Action) would have the least amount of direct and indirect impacts to the Covered Species and Non-covered species active at night. This alternative would produce the least amount of renewable energy. Alternative 2 (Proposed Action) would pose a higher risk of impacts to Covered and Non-covered Species at night, but would provide avoidance, minimization, and mitigation that would fully offset the requested take of the Covered Species and provide potential benefits to MBTA and other non-covered wildlife in the mitigation area. Alternative 3 (No Curtailment Alternative) would have the greatest impacts to Covered and Non-Covered species during the nighttime hours but would provide offsetting mitigation commensurate with take for Covered Species. This option would provide the most renewable energy. Given the level of uncertainty and lack of scientific evidence, it is unknown if Alternative 4 (Increased Cut-in Speed) would reduce impacts to Covered and Non-Covered species.

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